DOCUMENT RESUME

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ABSTRACT

Presented are the proceedings of the annual seminar (1971) of the Documentation Research and Training Centre (DRTC), Indian Statistical Institute. The text of 26 reports appears under the following major section headings: (1) Abstracting, indexing and reviewing periodicals; (2) Pattern of use of documents by specialists; (3) Comparative Study of schemes for library classification; and (4) DRTC Research Cell: Report for 1971. (SJ)

DOCUMENTATION RESEARCH AND TRAINING CENTRE (= DRTC)

112 Cross Road 11, Malleswaram, Bangalore 3.

1 OBJECTIVE

The Documentation Research and Training Centre, established in 1962 by the Indian Statistical Institute, has the following objectives:

1 To do and to promote continuing research in documentation;
2 To give a course of training in documentation; and
3 To give advisory service in documentation.

2 THE COURSE

The course offers comprehensive instruction in the theory and practice of documentation. It places emphasis on imparting theoretical knowledge of a high order and at the same time on equipping the student with the necessary professional competence based on practical experience. Instruction is largely individual. Tutorials, small group discussions, and weekly colloquia are organised so as to develop in the students the capacity for systematic thinking and for clear exposition.

In the observational study period, the trainees are given an opportunity to visit and observe the working of specialist libraries, industrial units, and research laboratories. They are also given practical working knowledge of document finding with mechanical aids such as punched cards and computer. They also receive instruction and experience in the organisation and managerial aspects of reprography and translation work.

21 ANNUAL SEMINAR

The Annual Seminar, turned on some specific area of documentation, forms an integral part of the course.

22 HOSTEL

To make this participative work possible, the DRTC is made a residential institution. Living in the hostel attached to it is obligatory.

Group 1

1 Universe of Subjects: Its Development and Structure;
2 Depth Classification (Theory):
3 Depth Classification (Practice);
4 Library Catalogue.

Group 2

5 Documentation;
6 Management of Specialist Library;
7 (i) Mechanised Document Finding Systems;
(ii) Elements of Statistical Analysis.
8 A Project in Documentation.

Group 3

9 A Project consisting of the Survey of the Trend in Current Research in a Specific Subject.
10 Observational Study.

31 PROJECT 1

The project in documentation, to be completed during the formal course in DRTC, consists of the preparation of a documentation list by each student on a specific subject. The work involves scanning and selecting articles from an approved set of periodicals relevant to the subject, minutely classifying the documents, preparation of abstracts of the documents, and preparation of the necessary added entries.

A Depth Schedule for the classification of the subject covered by the documentation list is also to be worked out simultaneously for the minute classification of the documents.

Continued in cover page 3

DRTC Annual Seminar

1 Proceedings of the DRTC Seminars.

1 ; 1963 : Documentation Periodicals : Coverage, Arrangement, Scatter, Seepage, and Compilation. Not Available

2 ; 1964 : Document Retrieval : Classification.

3 ; 1965 : Depth Classification : Subject Heading. OP

4 ; 1966 : Universe of knowledge ; Depth Classification ; Documentation List. OP

5 ; 1967 : Developments in Classification ; Management of Reprography Service ; Subject Headings and Feature Headings.

6 ; 1968 : Theory and Practice of Abstracting ; Developments in Classification ; Teaching Techniques in Documentation.

7 ; 1969 : Subject Analysis for Document Retrieval Systems; Quantification and Librametric Studies ; Management of Translation Service.

8 ; 1970 : Library Cataloguing : Rendering of Names of Corporate Bodies. Subject Analysis, with special Reference to Social Sciences. Documentation Systems for Industry.

9 ; 1971 : Abstracting, Indexing, and Reviewing Periodicals. Pattern of Use of Documents by Specialists. Comparative Study of Schemes for Library Classification.

DRTC Mid–Year Seminar

1 ; 1969 : Colon Classification, Ed 7.

2 ; 1970 : Cataloguing.

3 ; 1971 : Reference Service.

OTHER RECENT REPRINTS :

1 RANGANATHAN (S R). Colon classification. Ed 7 (1971): A preview. 1969. 52 P.

2 RANGANATHAN (S R) and BHATTACHARYYA (G). Conflict of authorship: Corporate Body *vs* Corporate Body. 1970. 65 P.

3 BHATTACHARYYA (G). Cataloguing research in India. 1969. 85 P.

4 NEELAMEGHAN (A) and SANGAMESMARAN (S V). Food Technology : Depth version of CC. 1970. 82 P.

ED 060860

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(INDIAN STATISTICAL INSTITUTE)

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ANNUAL SEMINAR

9

ABSTRACTING, INDEXING, AND REVIEWING PERIODICALS

PATTERN OF USE OF DOCUMENTS BY SPECIALISTS

COMPARATIVE STUDY OF SCHEMES FOR

LIBRARY CLASSIFICATION

LI 003 524

PART 1 : PAPERS

112 CROSS ROAD 11, MALLESWARAM

BANGALORE 3

1971

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CONTENTS

Paper	Author and Title	Page
	Area 1 : ABSTRACTING, INDEXING, AND REVIEWING PERIODICALS	
AA	RANGANATHAN (S R) and SEETHARAMA (S). Slimming the abstract of a paper : Symbiosis between the subject heading within a main entry and the abstract.	9-29
AB	REVANNASIDDAPPA (H C) and LALITHA REVANNASIDDAPPA. Abstracting periodicals in the aerospace sciences : An evaluation.	30-57
AC	MALWAD (N M), RAGHAVENDRA (M K) and KAMATH (V A). Indexing and abstracting periodicals in nuclear science and technology: An evaluation based upon their use at the Bhabha Atomic Research Centre.	58-84
AD	SHAH (P C). Abstracting and indexing periodicals in textiles and allied subjects.	85-100
AE	JAYARAJAN (P). "Bulletin of peace proposals": An evaluation.	101- 12
	Area 2 : PATTERN OF USE OF DOCUMENTS BY SPECIALISTS	
BA	NEELAMEGHAN (A). Use of information in research, invention, and innovation : Case studies.	115-38
BB	ROSEN (Stephanie) and FENNIG (Sharon). Use of the publications of international organisations in the Graduate School of International Studies, University of Denver.	139-63
BC	RAGHAVENDRA RAO (G S). Pattern of use and search for documents by specialists : A case study through citation analysis, questionnaire, and interview.	164-89
BD	NAGARATHNA (R A). Use of documents by nuclear physicists and metallurgists : A case study.	190-204
BE	GUNDU RAO (D). Citation of documents in radio engineering : A case study.	205-16

Paper	Author of Title	Page
BF	KARTHIKEYAN (S). Citation of documents by specialists : A case study.	217-31
BG	JOHNSON (E). Use of information by biologists: A case study.	232-7
BH	RAGHAVENDRA RAO (G S). Kinds of impact of information on post-graduate research : Case studies.	238-64
BJ	RAVICHANDRA RAO (I K). Obsolescence and utility factors of periodical publications : A case study.	265-82
	Area 3: COMPARATIVE STUDY OF SCHEMES FOR LIBRARY CLASSIFICATION	
CA	RANGANATHAN (S R). Dominant area for research in classification in the immediate future.	285-302
CB	BHATTACHARYYA (G). Classifying by UDC and by CC.	303- 51
CC	JAYARAJAN (P) and GOPINATH (M A). Classification of complex subjects in CC and UDC.	352-70
CD	NEELAMEGHAN (A) and GOPINATH (M A). Fused main subjects.	371-404
CE	RANGANATHAN (T) and NEELAMEGHAN (A). Compatibility of UDC with a freely-faceted version of CC: A case study.	405-33
CF	PARAMESWARAN (M). Geology in CC and UDC schedules.	434-45
CG	SEETHARAMA (S) and GOPINATH (M A). Classification of books on disease in medicine : A comparative study of CC and UDC class numbers.	446-66
CH	NEELAMEGHAN (A). Trend of research in notational system for library classification, with particular reference to the Colon Classification.	467-502
	Area 4 : DRTC RESEARCH CELL : REPORT FOR 1971	
DA	GOPINATH (M A). Classification research.	505-18
DB	BHATTACHARYYA (G). Cataloguing research.	519-27
DC	GOPINATH (M A). Studies in documentation	528-33
DD	RANGANATHAN (S R). Ten years of work : A review and a preview.	534-56

C O N T E N T S

AREA 1 : ABSTRACTING, INDEXING, AND REVIEWING PERIODICALS

Paper	Author and Title	Page
AA	RANGANATHAN (S R) and SEETHARAMA (A): Slimming the abstract of a paper: Symbiosis between the subject heading within a main entry and the abstract.	9-29
AB	REVANNASIDDAPPA (H C) and REVANNASIDDAPPA (Lalita). Abstracting periodicals in the aerospace science sciences: An evaluation.	30-57
AC	MALWAD (N M), RAGHAVENDRA (M K) and KAMATH (V A). Indexing and abstracting periodicals in nuclear science and technology: An evaluation based upon their use at the Bhabha Atomic Research Centre.	58-84
AD	SHAH (P C). Abstracting and indexing periodicals in textiles and allied subjects.	85-100
AE	JAYARAJAN (P). "Bulletin of peace proposals": An evaluation.	101-12

DRTC Seminar (9)(1971). Paper AA.

SLIMMING THE ABSTRACT OF A PAPER: SYMBIOSIS BETWEEN THE SUBJECT HEADING WITHIN A MAIN ENTRY AND THE ABSTRACT.

S R RANGANATHAN, National Research Professor in Library Science, and Honorary Professor, DRTC, Bangalore 3, and S SEETHARAMA, DRTC, Bangalore 3.

/The rules of the Classified Catalogue Code are amended so as to insert in the second section of a Main Entry the translation of the Class Number in Facet terms so as to serve as Subject Heading. The Feature Heading are further restricted to Class Numbers, with not more than three facets. Eighteen examples have been given to illustrate the changes. It is requested that the result of this proposal on the helpfulness to and tempo of specialist readers when compared with the same if each Class Number is used for providing with a Feature Heading, irrespective of the number of facets, be examined/.

1 INTRODUCTION

11 Opportunity for Experimental Observation

This Paper is in a sense a sequel to an earlier paper on symbiosis of abstract with feature heading in the classified part of the Catalogue (1). This is done to provide an opportunity for experimental observation by interested librarians, of the relative values of symbiosis of abstract with feature heading and with subject heading in the main entry of a document.

12 Value of Subject Heading Within a Main Entry

The present rules of the Classified Catalogue Code of S R Ranganathan do not provide for subject heading in the main entry. They provide only for Call Number being put in the leading section. However, experience during the last forty five years is now bringing the conviction that the users of the main entry will be better helped if the Subject Heading of the document is added as the second section in the main entry, than they are at present without this help.

13 Structure of Subject Heading Within a Main Entry

The Subject Heading within the Main Entry of a document will consist of facet terms, got by the translation of each facet number in the Class Number of the document. The facet terms will fall in the same sequence as the facet numbers. Further, the indicator digit preceding each facet number will be inserted before its corresponding facet term.

2 AMENDED RULE FOR MAIN ENTRY

To implement the above-mentioned idea, the rules for Main Entry in an abstracting periodical (documentation list) will, in effect, be made to read as shown below the following Note:

Note.- 1 The rules are stated as for a Card Catalogue.

2 A Catalogue in cards is necessary only when the Catalogue is not frozen but is continuously

growing, and new entries will have to be interpolated at any point. But a documentation list is seldom maintained in an ever growing state. On the other hand, by and large it is a frozen one. Therefore, the entries are handwritten or printed or typed or mimeographed continuously in successive pages or sheets. All the sections beginning with the Serial Number cum Book Number cum Heading Section of the Main Entry should be put down as a separate sentence, in a single paragraph or in two paragraphs, if it is more helpful to put the abstract as a separate paragraph from the one mentioned above. The examples given in this paper follow this prescription.

20 Three Vertical Lines in the Entry

Each entry in a documentation list has a leading line and three vertical lines. The serial number section starts on the first vertical and all other sections start either in second or third vertical as prescribed.

201 Style of Writing

If handwritten, library hand should be used in all the sections of the entry.

202 Main Entry

The Main Entry is to consist successively of the following sections:

1 Leading section (Class Number Section);
2 Subject heading section;
3 Serial number cum Book number cum Heading section;

4 Title section;
5 Location section; or bibliographic section;
6 Note section, if any; and
7 Abstract section.

21 Leading Section

1 Choice.- The leading section is to consist of the Class Number of the document.

2 Source.- The Class Number is to be taken from the back of the title page, if the document is physically an independent one; otherwise, it should be constructed.

3 Starting Point.- The Class Number should start from the second vertical.

22 Subject Heading Section

1 Choice.- The Subject Heading Section is to consist of facet terms, got by the translation of each facet number of the Class Number of the document.

2 Rendering.- The facet terms should be rendered in the same sequence as the facet numbers, and each facet term is to begin with a Capital. Further, the indicator digit preceding each facet number will be inserted before its corresponding facet term.

3 Starting point.- The Subject Heading should begin from the second vertical.

23 Serial Number cum Book Number cum Heading Section

230 Parts

The Serial Number cum Book Number cum Heading

Section is to consist of the Serial Number, Book Number and the Heading successively.

231 Serial Number

1 Choice.- The Serial Number of the Main Entries in a documentation list should begin with "1" for each such list.

2 Starting Point.- The Serial Number should begin from the first vertical.

232 Book Number

1 Choice.- The Book Number is to be taken from the back of the title page, if the document is physically an independent one; otherwise it should be constructed.

2 Starting Point.- The Book Number should begin from the second vertical or two spaces, after the end of the serial number if necessary.

233 Heading

1 Choice.- The rules given in Chap MD of CCC are applicable virtually, with one exception, it being the rule for Joint Authors.

2 Joint Author.- Notwithstanding Sec MD33, the Heading of the Main Entry of a Micro Document without independent physical existence is to give the names of all the joint authors even if their number exceeds two.

3 Starting Point.- The Heading should begin

from the third vertical, or two spaces after the end of the Book Number, if necessary.

24 Title Section

1 Choice.- The rules given in Chap ME of CCC are applicable here virtually.

2 Starting Point.- The Title should begin from the third vertical.

25 Location Section

1 Choice.- Specification of the host document and the place of occurrence within it or the locus is to contain successively the following and is to be enclosed in circular brackets:

(i) Title of the host document, using standard abbreviations in the case of periodical such as the one indicated in Chap RF of CCC;

(ii) Full stop;

(iii) Comma;

(v) "N" followed by the number of the fascicule;

(vi) Semicolon;

(vii) Year of the volume of the host periodical;

(viii) Comma;

(ix) Month or other specification of the fascicule of the host periodical;

(x) Semicolon; and

(xi) Number(s) of the page(s) of occurence or locus in inclusive notation as prescribed in Sec ED91.

Note.- Categories 5, 8, 9 may be unnecessary if the volume of the host periodical has continuous pagination. A similar prescription should be followed for books.

25 Alternative Bibliographic Section

Specification of collation and imprint in the case of document with independent existence is to be as prescribed in Sec SE13 and SE14 for the National Bibliography.

26 Note Section

1 Choice.- The rules given in Chap MF of CCC are applicable here virtually.

2 Starting Point.- The Note Section should begin from the third vertical.

27 Abstract Section

1 Choice.- The Abstract Section is to consist of the Abstract of the Micro Document or an annotation on the Macro Document as the case may be.

2 Starting Point.- The Abstract should begin from the third vertical.

28 Continuation Lines

All continuation lines of any section should begin at the second vertical.

15

291 Tracing Section

In a Documentation List, the tracing section is to be omitted in the Main Entry.

3 MULTIFOCAL DOCUMENT

If a Micro Document without independent physical existence is multifocal, a separate Main Entry and not a Cross Reference Entry is to be given for it under the Class Number of each of its Foci and with its own Abstract.

4 CONSOLIDATED ENTRY

In a documentation list, the Main Entries of all the documents sharing the same Class Number should be consolidated into a single entry.

5 FEATURE HEADING

1 Number and Choice.- In a documentation list, normally feature headings should not have more than three facets. It goes without saying that these will contain the first, the first two, and the first three facets common to all the Class Numbers in the Main Entries covered by them.

2 Style of Writing.- In the case of a printed documentation list, the typography for feature headings should be as prescribed in Sec SJ52 and its subdivisions of CCC.

6 EXAMPLES

The latter part of the Note for frozen list under Sec 2 is observed in the following examples. The

The examples have been taken f rom (1) Indian Library science abstracts, and (2) Library and information science abstracts.

2 Library Science
2
Library Science

1 N67 MUKHOPADHYAY (D). Abhab o granthagar bignaner darshan. (Principle of scarcity and philosophy of library science). (Granthagar. 17,N4;1967;145-8).

Libraries were organised for its utility to men and the principle of scarcity plays a vital role in this matter. Library has evolved from museum to distribution-centre. The organisation of knowledge is becoming complicated day by day and libraries in developed countries take the shape of Documentation Centre.

2 -- --. Granthagar begnaner darshan. Pratham sutra. (Philosophy of librarianship: the first law). (Granthagar. 17,N5;1967;187-92).

The collection of a library should be according to its reader. The more the reader acquires the power to learn the need for service of the library will be less. Library must be based on the national characteristics. The organisation of libraries should be by a band of well informed persons. The proper development depends upon well-trained library personnel. Library techmqies may be different in different countries according to the national

characteristics. We should solve our own problems ourselves and should not look at other countries for their solution.

3 -- MUTHUSWAMI (A). Noolagaviyal-or-arimukam (Library science - an introduction). (Noolagam. 1,N8;1967;32-6).

Library science has acquired the status of a discipline recently. The different aspects of this discipline eg, bibliography, book selection, library organisation, administration, classification, reference service are explained. Different types of bibliographies are enumerated.

2,34 Library, University
2,34

4 N67 DESHPANDE (K S). Problems facing university libraries. (Timeless fel. 1966-7;95-117).

The library needs to be regarded as an independent authority with the librarian enjoying the powers and status of the Head of a Post-graduate department. There should be several sections in the library each headed by a senior qualified person. The library building should be centrally situated in a campus and should be functionally planned, with the librarian fully participating in its planning. Selectivity should be the watchword of book acquisition. Co-operative acquisition should be vigarously pursued. University libraries should be regarded as depository

centres for government documents. In view of the crisis of devaluation, the UGC should double the book grants. Universities should aim at setting apart 10% of their budget for the development of their libraries. Programmes such as orientation courses, issuance of library guides, centralisation of book collection, institution of reference service etc, should be sponsored to promote use of books. Open access should be insisted upon and normal loss of books should be deemed as inevitable. Libraries should cooperate with each other in matters of compilation of union catalogues, inter-library loans, book acquisition etc.

5 --. --. The hundred and one sutras. (Timeless fel. 1966-7;119-29).

Enumerates in the form of 'Sutras' how and what should be done in order to vitalize the university libraries. They are given under the following broad headings: 1 Management of the library. 2 Building and equipment. 3 Books and serials. 4 Finance. 5 Promotion of the use of books. 6 Library co-operation.

6 N70 HUMPHREYS (K W). Libraries in new universities. (Int libr rev. 2,N3;1970;307-28).

<u>Considers report from various countries together with relevant literature examined by the author</u>.

Covers the following countries: USSR; Czechoslovakia; West Germany; Sweden; Finland; UK; Canada; USA; Australia; Israel; Congo; Ethiopia; Malawi; Nigeria; Rhodesia; Senegal; Zambia. The librarian's appointment date in relation to the University's foundamental. Time available for collection building before students arrive is also critical. Organisation of the new libraries shows remarkable similarity. There is little evidence of cooperation between new universities, although California's experience in setting up 3 universities with identical basis stock is important. An appendix gives the recommendations on new university libraries made at the Frankfurt Council 1968.

2,34.462 'N7
Library, University. Kuwait
7 N70 BADR (A) and SULAIMAN (K). Kuwait University libraries. (Unesco bull. libr. 24,N2;1970;79-82).

In September 66, 6 professional librarians were given the task of organising Kuwait University libraries from a jumbled heap of books and periodicals. By the end of 1968, 5 organised libraries with 140,000 volumes had been established. The libraries department comprises the central library and faculty libraries. Technical services are operated centrally. Total budget of the libraries, 1968-9, was 110,000 dinars. Staff comprises 15 professional librarians, 6 Kuwait University graduates, 3 reprography and audio-

20

visual specialists, and 25 library assistants and clerks. The following are described: Collection and technical organisation; reader services; reprography and audiovisual services; bibliography, documentation and information; training, research and missions.

2,34.615,d,9N
Library, University. Malawi University Library
8 N70 PLUMBE (W J). University of Malawi library. (Rhod Lib. 2,N3;1970;83-7).

The nature of the university, so far, has been experimental and this has influenced the library's development. There has been reluctance to accept the library committee as the policy-making body. One problem is that the library is in 6 different places. Inspite of this, the main difficulties have not been distance or communication but administrative control, staffing and finance. Development, has, however, not been too slow. After 4½ years, there are 92,000 volumes, 3 buildings, a main library has been planned, a bindery established and arrangements made for systematic Malawanization of the staff. Stock, research materials, staff, classification, cataloguing, buildings, micro text/photographic facilities, expenditure and cooperation are described.

2,34.677 'N7
Library University. Egypt
9 N70 AMAN (M M). Egyptian university libraries.

21

(Intr lib rev. 2,N2;1970;175-81).

There are 2 distinct types of libraries: Comprehensive, comprising humanities and social sciences which are rich in old and scholarly materials; and technical/science, with relatively new collections emphasising foreign publications. In both, the number of volumes seems unsatisfactory for increasing demands, eg., Cairo University's 57,440 students are served by 215,000 volumes. There are 3 categories of staff: (1) Professional; (2) Library assistants; (3) Technicians, stack personnel, typists etc. The director has a post-graduate degree, not necessarily in library science. Each librarian is personally responsible for books under his supervision. This discourages lending and open access. Cooperative acquisition, centralised processing, sharing of resources and inter loans are needed.

2,34:8 Library, University: Management

2,34:8
Library, University: Management

10 N68 KILPELA (R). The administrative structure of the university library. (Coll res lib. 29, N6;1968;511-6).

The typical large university library is a highly decentralised structure composed of numerous divisions and/or departments and departmental libraries. The popularly accepted notion that the university library usually comprises the two

22

divisions of technical and public services, each administered by a division head who is responsible for the coordination of all such services, is more apparent than real. There is an average of seven librarians with line authority reporting to the library director. There appears to be a need to reduce this number and to place this responsibility in two or three officers on a secondary level.

11 N70 KASER (D). Modernising the university library structure. (Coll res lib. 31,N4;1970;227-31).

The traditional pyramidal structure within university library results in a lack of widespread participation by professional librarians in the determination of the library's goals and standards. A peer structure would allow professional staff, trained in all aspects of librarianship, to speak with equal obligation on any library issues. The need for security, when expressing individual views may require a policy of rotating or elected departmental head-ships and a great emphasis on promotion in professional rather than administrative rank. The traditional and peer structures may well function in parallel, with different responsibilities being delegated to each. In order that the librarians may be accepted in the University as high-order academic officers, the official work week in libraries should be eliminated so as to transfer the responsibility for determining the effective

work load and standards of the organisation from library management to the individual and the peer structure.

2,34:8.44'N7
Library, University: Management.. ... India.

12 N67 GUPTA (R K). Emerging pattern of administrative organisation of university libraries with special reference to Indian conditions. (IASLIC bull. 12,N2;1967;136-41).

Describes purposes of a university and a university library and explains heterogenous organisational set-up of university libraries in India. Explains lack of appreciation of library services in the universities and deplores the conditions of library professionals working there, but ends with an optimistic conclusion.

2,34:8;N
Library, University: Management; Public Relation

13 N67 BENNETT (W). Teaching the use of libraries. (Timeless fel. 1966-7;25-32).

The number of students seeking admission to university courses has been on the increase in recent times and consequently the number of teachers is also increasing. The impact of this two fold increase has been responsible for the establishment of more universities. Libraries play a vital role in the teaching and study

programmes of universities. To promote the use of reading materials, programmes like freshman orientation, issuing of library guides, organisation of seminars in research methods and techniques, etc are suggested.

2,34:8;N.654
Library, University: Management Public relation. Nigeria

14 N69 OSUNDINA (O). University library in Nigeria and the need for public relations. (Nigerian lib. 5,N2;1969;55-61).

Factors influencing good public relations in the university library are: (1) determining group attitudes; (2) analysing opinion; (3) policy formulation; (4) planning the improvement of society's attitude; (5) carrying out the planned activities. With these, the library has the basis for that service which is the foundation of good PR, but there must be other ingredients; technique and approach are described. In Nigeria, university libraries serve the public as well as students and faculty. The annual orientation course for freshmen, student employment on library work and library guides are discussed.

2,34: 8,8.8
Library, University: Management Staff. Australia.
15 N69 BORCHARDT (D H). Some administrative and professional issues in Australian university libraries. (Aust univ. 7;N3;1969;204-25).

25

Librarianship is inseparable from a master/servant relationship because of its dependence upon employers. Most chief librarians have the status and salary of professor. The problem now is the integration of the library's objectives with those of the university and the professional contribution of the librarian to university life. The chief librarian should be on the budget committee as the library budget represents a major spending area. He should be present when academic planning is discussed. The library committee should be presided over by the chief librarian and include those aware of long range university policy and senior library staff. Senior librarians should have high qualifications. Those in charge of selection and organisation of material must have direct access to the chief librarian and sufficient academic standing to deal directly with the teaching staff. Senior positions often go to those with the administrative ability to supervise staff, but specialists should have senior rank on the strength of their intellectual contribution. The administrative pattern must be adaptable.

2,34:8,8;E.7311,d,9N
Library, University: Management. Staff; Budget.
New York, State University of New York Library
16 N70 Fairholm (G W). Essentials of library manpower budgeting. (Coll res lib. 31,N5;1970; 332-40).

26

As a result of the increasingly competitive nature of the quest for funds for libraries in state supported institutions, the State University of New York has prepared a man power budget. The formula relies on a correlation of work effort in libraries to 5 'descriptors' of an academic library; holding; acquisitions; full-time equivalent users: head count users; and university staff. Units of measure, unit standards, application factors and weighted standard times were drawn up with a separate table showing administrative standards. A formula was set up to relate this quantitative data in a meaningful way and facilitate budget forecasting for university library staff. The formula, although flexible, only represents staff needs for routine, continuing library functions.

2,34;55.593,d,9N
Library, University; Cataloguing. Austria, Innsbruck University Library
17 N70 WEIXLEDERER (R). Renewal of the old catalogue of Innsbruck University library. (Biblos (Austria). 19,N3;1970;207-13).

The catalogue, formerly in 7 alphabetical sequences, and consisting in the main of 110 handwritten ledgers with adenda, and other sequences on cards or slips, has taken 15 years to revise. The library now has a card catalogue and every effort has been made to correct errors and inconsistencies.

27

2,34;55:8.56
Library, University; Cataloguing: Management, Staff. United Kingdom

18 N69 FRIEDMAN (J) and JEFFREYS (S). Cataloguing and classification in British university libraries. Part 2. The labour force. (J docum. 25,N1;1969; 43-51).

Part 2 of a questionnaire-based survey into cataloguing and classification practices and procedures in university libraries. A cost analysis is given, showing a general picture of activities in the 43 libraries involved -- the division of labour, distinction between professional and non-professional staff, grades of salaries and the amount of time spent on various tasks. It was found that graduates spent more time on cataloguing and classification, than any other activity and in the newer universities they spent proportionately more time on book selection. The prospect of automation in cataloguing procedures pinpoints the need for professional cataloguers to use their knowledge of the stock more and more on the side of reader assistance.

7 OMISSION OF INDICATIVE PART OF ABSTRACT

The possibility of slimming the abstract by omitting its indicative part underlined in the above examples can be easily seen. Another example will be found in

RANGANATHAN (S R). Abstract and feature heading: Symbiosis. (Annual Seminar (DRTC). 6;1968;Paper AF).

28

8 OPINION SOUGHT

Opinion is sought whether the restriction of feature headings to Class Number of three facets will be found more comfortable, less irritating and sufficient by specialist readers, than giving a feature heading for every Class Number and irrespective of the number of facets in it. For comparision, the examples in Sec 6 of this Paper may be used. Opinion is also sought whether it will be helpful to readers to give the subject heading section as prescribed in the rules and illustrated in the examples.

DRTC Seminar (9)(1971), Paper AB.

ABSTRACTING PERIODICALS IN THE AEROSPACE SCIENCES: AN EVALUATION.

H C REVANNASIDDAPPA, Library, National Aeronautical Laboratory, Bangalore 17, and LALITA REVANNASIDDAPPA, Librarian.

[The essential function of an abstracting periodical and the need for a comparative study of abstracting periodicals in a particular subject field are mentioned. The four abstracting periodicals -- Government reports announcements, Scientific and technical aerospace reports, Engineering index, and International aerospace abstracts -- covering documents in aerospace sciences have been compared in respect of the following features: (1) Time lag in coverage; (2) Coverage by language; (3) Arrangement of entries; (4) Structure of an entry; (5) Indexes; and (6) Byproduct. The findings in respect of each of these comparisons are commented upon].

Abbreviations Used:

(AP) = Abstracting periodical
EI = Engineering index
GRA = Government reports announcements
IAA = International aerospace abstracts
STAR = Scientific and technical aerospace reports

1 INTRODUCTION

11 Function of Abstracting Periodical

A function of an abstracting periodical (=AP) is to help the specialist keep abreast of the current developments in the subject of his specialisation. Another of its function is to facilitate retrospective search for documents on a specific subject. The (AP) is expected to provide information on documents relevant to the subject of interest to the specialist pinpointedly (that is, with a minimum of noise and irrelevancy), exhaustively (that is, with a minimum of leakage), and expeditiously, at a reasonable cost.

12 Need for Study of Abstracting Periodicals

With the enormous proliferation of documents due to the accelerated growth of most subjects in the universe of subjects, team research giving rise, at least in part, to the interdisciplinary character of subjects, and the publication of documents in a variety of languages, has made the emphasis on the above-mentioned attributes of the (AP) all the more necessary. With a view to aiding document search, the number of abstracting and indexing periodicals has also been increasing. Between themselves, the services are expected to cover the subject-field more or less exhaustively. There may be considerable overlap in coverage on the one hand and planned mutual sharing of the field among the services, on the other.

Abstracting periodicals have also been attempting to reduce the time lag in the coverage of documents, and also to shorten the production and distri-

bution time. Use of computer-aided systems for this purpose is an example.

From the point of view of the user -- librarian as well as reader it becomes necessary to examine the various attributes of the (AP) available in a particular subject. This will facilitate the selection of suitable (AP) in searching for documents on specific subjects and also in securing economy in the selection and acquisition of documents.

2 AEROSPACE SCIENCES

21 An Active Field

The aerospace sciences has been one of the most active subject fields during the past decade. For instance, the number of articles published in this subject increased from 35,000 in 1960 to 75,000 in 1970. Also, aerospace sciences is an inter-disciplinary subject overlapping several areas in different disciplines -- such as, mathematics, physics, engineering, chemistry, technology, and biological sciences.

There are several abstracting and indexing periodicals covering the field. Naturally, there is overlap in coverage among them and each service has its own special attributes.

22 Scope of the Paper

This paper describes and evaluates four (AP) covering the aerospace sciences -- namely

1 Government reports announcements;

2 Scientific and technical aerospace reports;
3 Engineering index; and
4 International aerospace abstracts.

The comparison and evaluation have been made in respect of the following factors:

1 Time-lag in coverage;
2 Coverage by language;
3 Arragnement of entries;
4 Structure of an entry;
5 Indexes; and
6 Byproducts and other services, etc.

23 Description

A brief description of each of the four (AP) is given in the succeeding sections.

231 Government Reports Announcements

Government reports announcements (= GRA) is published twice in a month, by the National Technical Information Service, Springfield, Virginia 22151. It was started in 1938 as the US Government research and development reports. The title was changed in 1971.

GRA covers, in addition to scientific and technical reports, reports giving business and economic information. It announces information on documents released to the public through the National Technical Information Service by the US Government Departments and Agencies. US Government-sponsored translations and some reports in foreign languages are also included.

232 Scientific and Technical Aerospace Reports

Scientific and technical aerospace reports (=STAR) is published twice a month, by the Scientific and Technical Information Office, National Aeronautics and Space Administration (NASA), Washington, D C 20546. It was started in 1963 as a successor to the Technical publications announcements published from 1958 to 1962.

STAR covers fairly comprehensively the current technical reports in aerospace sciences -- reports issued by NASA and its contractors, other US Government agencies and corporations, universities and research organisations throughout the world. NASA-owned patents and patent applications, translations, and other separate documents are also included.

234 Engineering Index

Engineering index (=EI) is a monthly, published by the Engineering Index Incorporated, 345 East, 47th Street, New York, N Y 10017. It was started in 1885. EI is a transdisciplinary (AP) covering engineering and its penumbral areas. It covers articles published in periodicals, papers contributed to conferences, selected books, and patents.

235 International Aerospace Abstracts

International aerospace abstracts (=IAA) is published twice a month (except June and December, which have 3 issues), by the Technical Information Services, American Institute of Aeronautics and Astronautics Inc, 750 Third Avenue, for the Institute and NASA. It was started in 1961. Coverage is similar to that of

STAR. But IAA mainly covers articles in periodicals, papers contributed to conferences, and translations of articles. STAR, as has already been mentioned, covers mainly technical reports. There is, however, a well established coordination between these two publications with a view to minimising unnecessary duplication of coverage.

24 Number of Abstracts

Table 1 gives the approximate number of abstracts published by each of the (AP). (FID. Abstracting services: Science and technology. Ed 2. V1, 1969).

241 Table 1. Approximate Number of Abstracts per year

SN	Periodical	N of abstracts per year
1	GRA	40,000
2	STAR	30,000
3	EI	72,000
4	IAA	19,000

25 Length of Abstract

Table 2 gives the approximate number of words in an abstract in each of the (AP).

251 Table 2. Average Number of Words Per Abstract

SN	Periodical	Average N of words per Abstract
1	GRA	250
2	STAR	200
3	EI	70
4	IAA	150

35

3 TIME LAG

31 Analysis of Citations

Five hundred documents abstracted in the following issues of the (AP) were examined:

1 Government reports announcements (=GRA). V71, N6; 1971 March.

2 Scientific and technical aerospace reports (=STAR). V9; N8; 1971, April 23.

3 Engineering index monthly (=EI). V9, N3; 1971 March.

4 International aerospace abstracts (=IAA). V 11, N1: 1971 January.

The date of publication of each of the 500 documents abstracted in each of the above issues of the (AP) was noted from the information given in the bibliographical citation. The difference in the date of publication of the issue of the (AP) and the date of publication of the document abstracted was taken as the time lag in coverage. The data derived in this way for 500 documents selected from each of the above mentioned issues of the (AP) are presented in Table 3 (See page 37) It should be noted that in respect of a particular library there will be an additional time lag in the receipt of the (AP) after its publication. For instance, it takes about 12 to 15 weeks for an American periodical to reach India by surface mail. This additional time lag is not considered here. Also, there may be a time lag between the scheduled date of publication of a periodical and its actual date of publication. This applies both to (AP) as well as to the periodicals covered by them.

32 Table 3. Data on Time Lag

Time Lag in (months)	Abstracting Periodical											
	G R A			STAR			EI			IAA		
	N of articles	% of 479	Cumulative %	N of articles	% of 493	Cumulative %	N of articles	% of 500	Cumulative %	N of articles	% of 500	Cumulative %
1	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	3	0.6	0.6
2	3	0.6	0.6	40	8.1	8.1	4	0.8	0.8	71	14.2	14.8
3	30	6.3	6.9	41	8.3	16.4	20	4.0	4.8	105	21.0	35.8
4	51	10.6	17.5	49	9.9	26.3	11	2.2	7.0	37	7.4	43.2
5	45	9.4	26.9	16	3.2	29.5	65	13.0	20.0	69	13.8	57.0
6	46	9.6	36.5	25	5.1	34.6	80	16.0	36.0	60	12.0	69.0
7	41	8.6	45.1	42	8.5	43.1	65	13.0	49.0	61	12.2	81.2
8	20	4.2	49.3	47	9.5	52.6	38	7.6	56.6	34	6.8	88.0
9	24	5.1	54.4	12	2.4	55.0	47	9.4	66.0	1	0.2	88.2
10	46	9.6	64.0	15	3.0	58.0	48	9.6	75.6	2	0.4	88.6
11	35	7.3	71.3	44	8.9	66.9	47	9.4	85.0	2	0.4	89.0
12	22	4.4	75.7	21	4.3	71.2	60	12.0	97.0	40	8.0	97.0

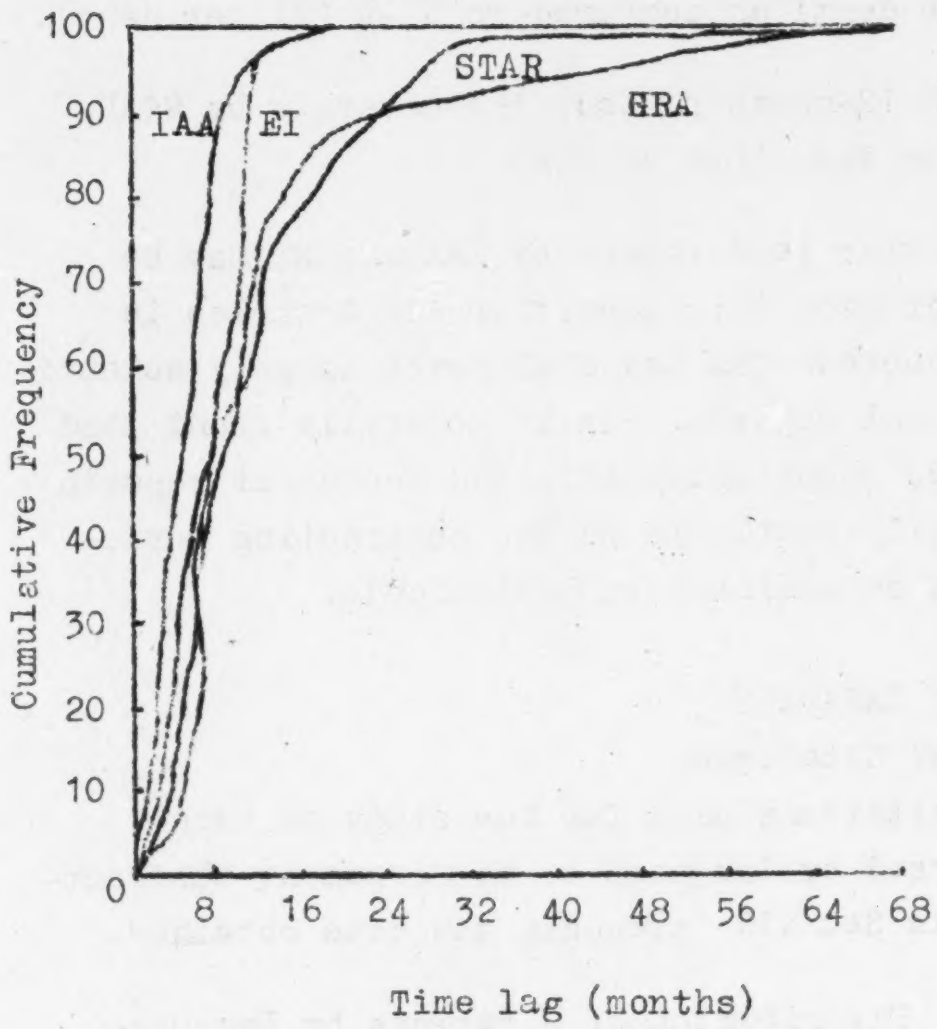
(Continued)

32 Table 3. Data on Time Lag. (Continued)

Time Lag in (months)	Abstracting Periodical											
	G R A			STAR			E I			I A A		
	N of articles	% of 479	Cumulative %	N of articles	% of 493	Cumulative %	N of articles	% of 500	Cumulative %	N of articles	% of 500	Cumulative %
12-24 (18)	56	11.7	87.4	58	11.8	83.0	15	3.0	100.0	15	3.0	100.0
24-36 (30)	19	3.9	91.3	75	15.0	98.0						
36-58 (42)	17	3.5	94.8	6	1.2	99.2						
48-60 (54)	13	2.7	97.5	1	0.4	99.6						
60 and above (66)	11	2.5	100.0	1	0.4	100.0						
	479	100.0		493	100.0		500	100.0		500	100.0	

33 Graph

Fig 1 represents graphically the time lag.



39

34 Annotation

1 The IAA has the least time-lag in service. For, it covers about 70 per cent of the articles in 6 months as compared to about 36 per cent for the other 3 abstracting periodicals, in the same period.

2 However, IAA and EI cover more or less the same percentage (97 per cent) of articles in a 12-month period. In the same 12-month period GRA and STAR give about 75 per cent coverage; the GRA being slightly better (76 per cent) as compared to STAR (71 per cent).

3 Beyond 12-month period, the coverage by STAR improves faster than that of GRA.

4 The better performance by IAA and EI may be due to the fact that they cover largely articles in periodicals, whereas GRA and STAR cover largely scientific and technical reports. It is generally found that the information about scientific and technical reports are not as easily available to the abstracting periodicals as that on articles in periodicals.

4 COVERAGE BY LANGUAGE

41 Analysis of Citations

The 500 citations used for the study on time-lag were analysed by language of the document abstracted. Table 2 in Sec 411 presents the data obtained.

411 Table 2. Distribution of Citations by Language

Language	GRA		STAR		EI		IAA	
	N	%	N	%	N	%	N	%
English	479	94.8	435	87.0	475	95.0	312	62.4

Language	GRA		STAR		EI		IAA	
	N	%	N	%	N	%	N	%
German	7	1.4	17	3.4	3	0.6	31	6.2
Italian	3	0.6	1	0.2			5	1.0
French	6	1.2	23	4.6	5	1.0	16	3.2
Russian	8	1.6	24	4.8	15	3.0	118	23.6
Bulgarian							5	1.0
Slovak							1	0.2
Polish	2	0.4			2	0.4	8	1.6
Ukaranian							4	0.8
Total	500	100.0	500	100.0	500	100.0	500	100.0

42 Annotation

1 Each of the four (AP) give maximum coverage of English language documents. IAA has the lowest coverage of such documents compared to the other three.

2 IAA has maximum coverage of Russian language documents (about 24 per cent). Taking all the East European languages as a whole, IAA gives about 27 per cent coverage as compared to less than 5 per cent coverage in the other (AP). IAA and STAR each give a better coverage of German, Italian and French documents taken together (about 10 per cent) than do GRA and EI.

5 ARRANGEMENT OF ENTRIES

51 Subject Headings

In each of the abstracting periodicals, the

entries in the main part are arranged under Subject Headings. The major Subject Headings are arranged in an alphabetical sequence in GRA, STAR and IAA. EI uses some 16,000 subject headings which are arranged in a strictly alphabetical sequence.

STAR and IAA use the same set of 34 subject headings (Subject Categories). GRA uses the 22 COSATI (Committee on Scientific and Technical Information, USA) Subject Headings (Subject Categories). The scope of each of the Subject Headings is given in each of the issues of GRA, STAR, and IAA.

52 Comparison

The following table gives some idea of the distribution of the subjects under the IAA/STAR subject headings in relation to GRA subject headings.

521 Table 3. List of Subject Headings

SN	GRA	STAR/IAA
1	Aeronautics	Aerodynamics Aircraft
2	Atmospheric science	Geophysics Meterology Space radiation Space science
3	Biological and Medical sciences	Biosciences Biotechnology
4	Chemistry (Inlcudes Chemical engineering)	Chemistry

SN	GRA	STAR/IAA
5	Electronics and Electrical engineering	Computers Electronics Electronic equipment
6	Materials	Materials, Metallic Materials, Nonmetallic
7	Mathematical sciences	Mathematics
8	Mechanical, Industrial, Civil and Marine engineering	Auxiliary systems, Instrumentation and Photography, Machine elements and processes, Structural Machanics
9	Navigation, Communications, Detection and Countermeasures	Navigation Communications
10	Nuclear science and technology	Nuclear engineering
11	Physics	Physics, General Physics, Atomic, Molecular and Nuclear Physics, Plasma Physics, Solid state physics, Fluid Mechanics, Thermodynamics and Combustion Masers
12	Propulsion and Fuels	Propulsion systems Propellants Thermodynamics and combustion
13	Space technology	Space science Space vehicles

53 Annotation

1 The subject heading "Chemistry" in GRA

includes "Chemical Engineering" also. "Chemical Engineering" is usually deemed either as a branch of or an Adjunct subject to, Engineering.

2 Under 22 subjects headings GRA covers all the subjects in the universe of subjects. Therefore, a number of subject headings in GRA either represent a Subject Bundle or a subject of great extension. STAR and IAA mainly cover aerospace science and technology, and therefore each of the 34 subject headings cover a more specific range of subjects.

3 As the subject headings are arranged in an alphabetical sequence, related subjects are scattered. An arrangement of the subject headings according to the mutual filiation among the subjects represented by them would be more helpful. The Principles for Helpful Sequence can be used here. A coextensive classification of the subjects of the documents according to a freely faceted scheme for classification, arrangement of the entries by the Class Number so designed and provision of class index entries using an appropriate version of Chain Procedure would be more helpful.

6 STRUCTURE OF AN ENTRY

In the succeeding sections, a specimen of the entry in the main part of each of the (AP) is given.

61 .GRA

7 Chemistry

7C Organic chemistry

AD-717432 REPRINT

44

Prduc Univ Lafayette Ind. Dept of Chemistry
A NEW ELECTROCHEMICAL METHOD FOR THE SELECTIVE REDUCTION OF ALIPHATIC AMIDES TO ALDEHYDES OR ALCOHOLS.
Robert A. Benkeser, Hamao Watanabe, Sherman J Mels, and Michael A Sabol 23 Jul 69,3p.

AFOSR-TR-71-0021
Grant AFAFOSR-822-67
Availability: Pub in Jnl of Organic chemistry, V35;4;P1210-11, April 70.

Descriptors: (Amides, Reduction (Chemistry)), Alcohols, Aldehydes, Synthesis (Chemistry)), Electrochemistry.

[Abstract]

62 STAR

33 THERMODYNAMICS AND COMBUSTION

N71-10429 # Lockheed Missiles and Space Co, Sunnyvale, Calif

LIMITATIONS IN THERMAL MODELING Technical Summary Report, 6 June 1967 - 8 Dec 1969.
R E Roling, D O Murray, and K N Marshall
Dec 1969, 245p refs
(Contract NAS8-21153)
(NASA-CR-102566;LMSC-6-78-69-41) Avail: NTIS CSCL20M

[Abstract]

45

AB63 Revannasiddappa and Lalita Revannasiddappa

63 EI

NUCLEAR REACTORS

Fission Products

Measurements of time-dependent energy spectra of beta rays from uranium-235 fission fragments; N TSOULFANIDIS (Univ of Missouri, Rolla), B W WEHRING, M E WYMAN;
Nucl Sci Eng V43 N1 Jan 1971;P42-53

[Abstract]

22 refs 17245

64 IAA

01 AERODYNAMICS

A71-1039≠ Arbitrary plane cascade consisting of thin and slightly curved profiles in a potential flow (Beliebiges ebenes Gitter aus den dunnen und Schwachgewolbten profiten in der potential stromung) Gheorghe Zidaru (Bucuresti, Institutal Politechnic Gheorghe Gheorghiu-Dej, Bucharest, Rumania). Bucuresti, Institutal Politechnic Gheorghe Gheorghiu-Dej, Buletinul, Vol 32, Mar-Apr 1970, P 111-24. In German.

65 Items of Information

The difference, if any, in the sequence of the bibliographical elements in each of the entries can be seen in table 4 in Sec 651.

651 Table 4. Sequence of Bibliographical and other Elements

Sequence	GRA	STAR	EI	IAA
1	Subject Heading	Subject Heading	Subject Heading	Subject Heading

46

Sequence	GRA	STAR	EI	IAA
2	Subject Group	NASA Accession N	Sub Heading (Subject)	AIAA Accession N
3	Accession N	Whether the document is a NASA sponsored document or not	Title of the document in English followed by the title in original language	Title of the document in English followed by the title in original language
4	Indication about reprint or price of the photostat copy and microfiche copy of the document	Availability on microfiche	Personal author(s) with affiliation of first author	Personal author(s) with affiliation (s) of author(s)
5	Corporate author	Corporate source (Corporate author)	Title, Volume N, Issue N, Date and Pagination of periodical	Title, Volume N, Issue N, Date and Pagination of host periodical
6	Title of the document (report) in English followed by the title in original language	Title of the document (report) in English followed by the title in original language	Abstract	Language of the document if other than English and N of references cited in original document

AB651 Revannasiddappa and Lalita Revannasiddappa

Sequence	GRA	STAR	EI	IAA
7	Personal author(s)	Personal author(s)	Language of the document of other than English and N of references cited in original document	Abstract
8	Date of publication	Date of publication		
9	N of pages	N of pages		
10	N of references in original document	N of references in original document		
11	Information about translation of the document wherever relevant	Language of the document other than English wherever relevant		
12	Report N	Contract/Grant N		
13	Grant/Contract N	Report N		
14	Availability	Availability		
15	Descriptors	Abstract		
16	Abstract or indication to the source such as STAR where abstract is given			

48

652 Annotation

1 The information presented in the above table indicates that GRA and STAR have more or less the same sequence among the bibliographical elements, whereas EI and IAA follow a different sequence. But EI and IAA follow more or less the same sequence among the bibliographical elements.

2 There is coordination in the coverage between STAR and GRA. IAA covers all kinds of documents, whereas STAR covers mainly technical reports. Hence, perhaps, the difference in the sequence of bibliographical elements among the two (AP).

3 GRA and STAR have more number of bibliographical elements in each entry than that either in EI or IAA. This is again due to the kind of documents covered by them. A report may be asked for and identified by Code Number, Accession Number etc. This kind of approach does not arise in the case of articles in periodicals and papers contributed to conferences.

4 It is helpful to conform to an international standard in respect of sequence of bibliographical elements in an entry for different varieties of documents.

7 INDEXES

70 In Each Issue

The types of indexes provided in each issue of each of the (AP) are indicated in Table 5

Sec 71. For GRA, the Government reports index is published separately for each issue.

71 Table 5. Variety of Indexes

N = No Y = Yes

SN	Type of Index	GRA	STAR	EI	IAA
1	Subject Index	Y	Y	N	Y
2	Personal Author Index	Y	Y	Y	Y
3	Corporate Source Index	Y	Y	N	N
4	Contract Number Index	Y	Y	N	Y
5	Report Number Index	Y	Y	N	N
6	Meeting Paper Index Number	N	N	N	Y
7	Accession Number Index	N	N	N	Y
Total Number of Indexes provided		5	6	1	5

72 Specimen of Entry in Index

Information about the entry in each of the indexes in each of the (AP) is given in the succeeding sections.

721 Subject Index

(AP)	Entry in Subject Index	Index Number
GRA	ACTUATORS REVIEW OF PNEUMATIC PISTON TYPE ACTUATORS FOR PROSTHETICS N71-15576 6L	Combination of Accession N and Subject field/ Group N.

STAR	ABSORPTION CROSS SECTIONS Investigating Characteristics and efficiency of fast power reactors /JPRS-52290/ C22N71-18783	Combination of Subject Category N and NASA Accession N
IAA	ABLATIVE MATERIALS Ablative heat shield char layer, examining reacting nonequilibrium pyrolysis gas flow /AICHE PREPRINT 15B/ C33A71-11297	Combination of Subject Category N and IAA Accession N

Note.- In the case of STAR and IAA, a 'Notation of Content', rather than the title of the document, appears under each Subject Heading.

722 Personal Author Index

(AP)	Entry in Personal Author Index	Index Number
GRA	ABILDSKOV, J A Review of Electrocardiography and Electrophysiology in relation to Myocardial Infarction PB-197 745 6E	Combination of Subject Category N, Group N, and Report N/Accession N

AB722 Revannasiddappa and Lalita Revannasiddappa

(AP)	Entry in Personal Author Index		Index Number
STAR	ADAMSON, T C, Jr	C12 N71-18455	Combination of Subject Category N and NASA Accession N
EI	ALEXANDER, E J	62-15746	Combination of Page N and Abstract N
IAA	ALTMAN, F J Storm reflectivity models	C20 A71-10585	Combination of Subject Category N and IAA Accession N

723 Corporate Source Index (Corporate Author Index)

(AP)	Entry in Corporate Source Index	Index Number
GRA	ADVISORY GROUP FOR AEROSPACE RESEARCH AND DEVELOPMENT, PARIS (FRANCE) AGARD-AG-145-70 WIND TUNNEL PRESSURE MEASURING TECHNIQUES N71-14988 14B	Combination of Subject Category N-Group N and Report N/Accession N

(AP)	Entry in Corporate Source Index	Index Number
STAR	ACADEMY OF SCIENCES / USSR /, LENINGRAD Linear transformation and absorption of waves in plasma /NP-18504/ C25N71-18165	Combination of Subject Category N and NASA Accession N

724 Contract Number Index

(AP)	Entry in Contract/N Index	Index Number
GRA	10-27 NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. LEWIS RESEARCH CENTER, CLEVELAND, OHIO. N71-14843 14B	Combination of Subject Category N-Group N and Report N/ Accession N
STAR	AF 49/638/-1577 C33 N71-18811	Combination of Subject Category N and NASA Accession N
IAA	AF 04/701/-69-C-0039 C12 A71-11595	Combination of Subject Category N and NASA Accession N

AB725 Revannasiddappa and Lalita Revannasiddappa

725 Accession/Report Number Index

(AP)	Entry in Report N Index	Index Number
GRA	NASA-CR-72817 DESIGN AND FABRICATION OF PRO-TOTYPE AUXILIARY LOOP HEAT EXCHANGER FOR SNAP 8 N71-14663 18N PC$3.00 MF$0.95	Combination of Subject Category N-Group N and Report N/Accession N
STAR	NASA-TN-D-5966 C07 N71-18565#	Combination of Subject Category N and NASA Accession N

726 Meeting Paper Number Index

(AP)	Entry in Meeting paper N Index	Index Number
IAA	AIAA PAPER 68-945 Col A71-10927	Combination of Subject Category N and IAA Accession N

727 Accession Number Index

(AP)	Entry in Accession N Index	Index Number
STAR	C19 N71-1009# Ad-710227	Combination of Subject Category N and NASA Accession N

54

(AP)	Entry in Accession N Index	Index Number
IAA	C24 A71-10137 #	Subject Category N

Note.- In the Accession N Index the entries are arranged by the Accession N and not by the Subject Category N although the latter is printed as the first item in the entry.

73 Cumulative Index

731 Periodicity

Table 6 gives information on the periodicity of the cumulative indexes of the (AP).

732 Table 6. Periodicity of Cumulative Indexes

N = No Y = Yes

(AP)	Quarterly	Semiannual	Annual
GRA	Y	-	Y
STAR	Y (upto V7;1969)	Y (from V8;1970)	
EI	N	N	Y
IAA	Y (upto V9;1969)	Y (from V10;1970)	Y

733 Structure

Each cumulative index of GRA, STAR, and IAA is a cumulation of each of the different varieties of indexes given in an issue of the periodical. An entry in each variety of cumulative index in each of the (AP)

AB733 Revannasiddappa and Lalita Revannasiddappa

is similar to the corresponding entry in the corresponding variety of index in an issue of the periodical with the following modification: The Subject Category Number used as the Index Number in the index in an issue is replaced by the Issue Number and Page Number in the entry in a cumulative index. An entry from the quarterly cumulative subject index of STAR is reproduced below:

ABLATING MATERIAL

Commercially available ablation materials used as thermal protection for sidewalls of advanced air-to-air missiles-protective coatings for structures in separated flow region

/NASA-TN-D-3093/ 01 P0085 N66-10666

The Engineering index annual is a cumulative index to the 12 monthly issues of EI. The structure of an entry in it is similar to that in an entry in a monthly issue of EI.

8 BYPRODUCT

The preparation and production of an (AP) may produce some useful byproducts. Here are some examples:

81 Byproduct of GRA

1 Clearing House announcements in science and technology (Semi-monthly); and

2 Fast Announcement Service.

82 Byproduct of STAR

NASA/SCAN. This is a selective announcement

service for STAR and IAA, useful in document search.

83 Byproduct of EI

1 Engineering Index Card Service;

2 CITE (Current Information Tapes for Engineers); and

3 COMPENDEX (Computerized Engineering Index).

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DRTC Seminar (9)(1971). Paper AC.

INDEXING AND ABSTRACTING PERIODICALS IN NUCLEAR SCIENCE AND TECHNOLOGY: AN EVALUATION BASED UPON THEIR USE AT THE BHABHA ATOMIC RESEARCH CENTRE.

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The Bhabha Atomic Research Centre (=BARC), Trombay, subscribes to sixty two indexing and abstracting periodicals. Nine of these periodicals are most frequently used by the scientists and engineers of the Research Centre. These have been evaluated on the basis of a questionnaire and personal interview method. The criteria used in the evaluation are: (1) Subject coverage; (2) Type of documents covered; (3) Indexes provided; (4) Abstract ; (5) Time-lag; (6) Arrangement of entries in an individual issue; (7) Bibliographic information; and (8) General lay-out and format. The findings of the survey are reported.

1 EVOLUTION OF INDEXING AND ABSTRACTING PERIODICALS

11 Abstracting Periodical

The earliest surviving periodical is the Philosophical transactions of the Royal Society of London, first published in 1665 (3). With the growth of scientific activity, the number of scientific periodicals also increased. By 1830, the number of scientific periodicals was well over 300. It was felt at this time that some sort of service was needed, which would survey broad fields of knowledge and summarise

all important current papers in those fields, thus providing a bird's eye view of the progress. The first attempt in this direction was the publication of the pharmaceutisches zentralblatt (afterwards Chemisches zentralblatt) which commenced in 1830. Gradually, a number of abstracting periodicals began to appear in other subjects. There are more than 500 abstracting periodicals at present for science and technology alone.

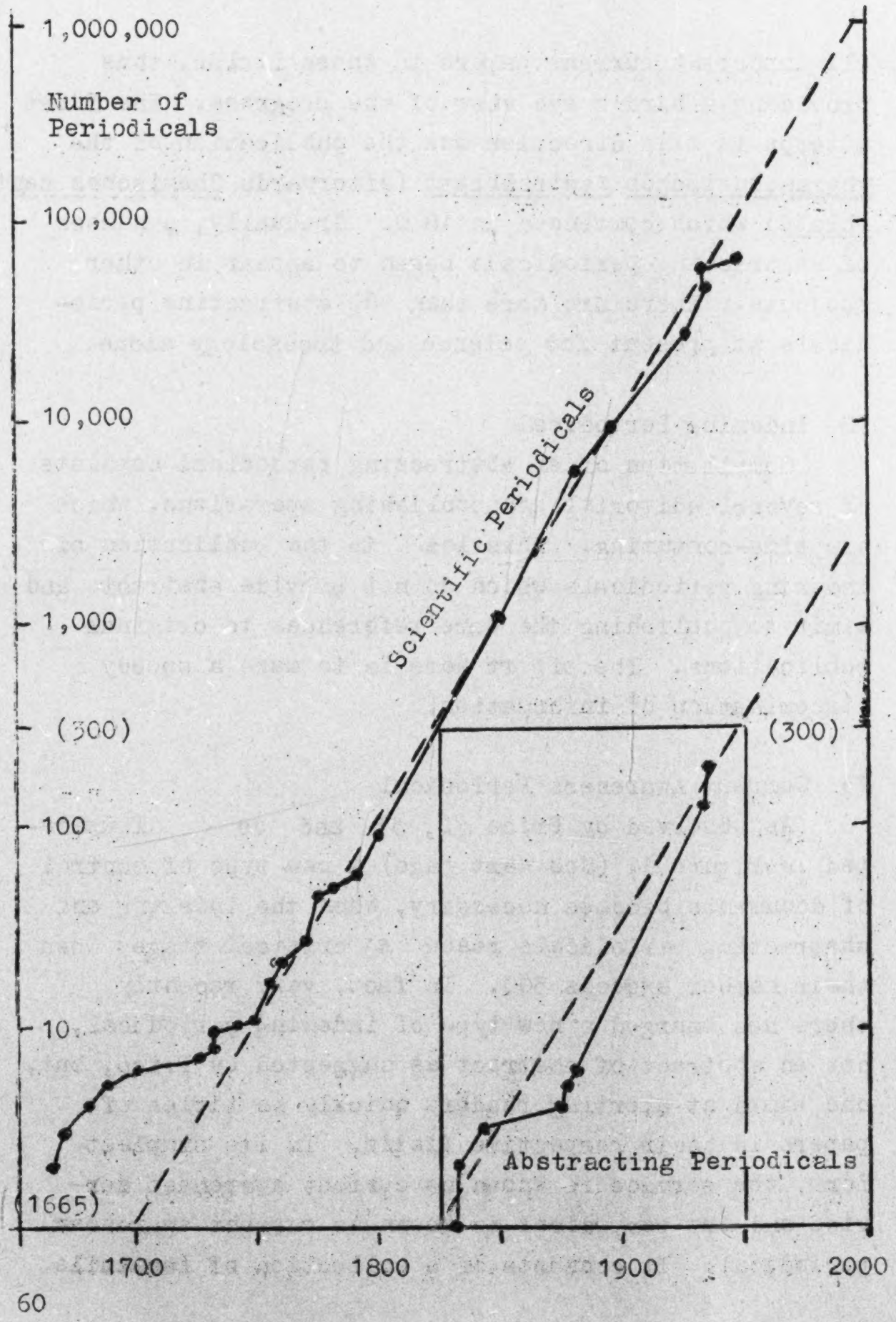
12 Indexing Periodical

Compilation of an abstracting periodical consists of several editorial and publishing operations, which are time-consuming. This led to the publication of indexing periodicals which do not provide abstracts and limit to publishing the bare references to original publications. The effort here is to make a speedy dissemination of information.

13 Current Awareness Periodical

As observed by Price (2, 3) and as illustrated in Figure 1, (See next page) a new type of control of documents becomes necessary, when the indexing and abstracting periodicals reach a critical stage: when their number exceeds 300. In fact, very recently there has emerged a new type of indexing periodical, not an abstract of abstract as suggested by Price, but, one aimed at alerting readers quickly to titles of papers in their respective fields. In its simplest form, the service is known as current awareness service and the periodical is known as current awareness periodical. It consists of a collection of facsimile

AC13 Malwad and Others



60

reproductions of contents page of individual periodicals. Generally, these services make use of modern reprographic techniques, computer technology etc, for fast reproduction. The Current contents, published by the Institute for Scientific Information (ISI), Philadelphia, U S A, since 1958, is a well-known example in this category. The other examples are: Chemical titles, a semi-monthly product of the Chemical Abstracts Service, which is a computer-produced key-word index; Current papers in physics, published by the Institution of Electrical Engineers (IEE) in association with the American Institute of Physics (AIP), since January 1966; Current papers on control; and Current papers in electrotechnology published by IEE.

2 INDEXING AND ABSTRACTING PERIODICALS IN NUCLEAR SCIENCE AND TECHNOLOGY

21 Scope of the Subject

The field of nuclear science and technology is quite extensive and includes a broad spectrum of subjects from aerodynamics to zoology and practically every living and non-living object where radiation effects are studied. Its circumferential line often transcends the conventional (and arbitrary) lines of division of science and technology into various distinct components. Nuclear science taken as a whole overlaps several other subjects, draws sustenance from them and creates new scientific disciplines in turn. Nuclear metallurgy, nuclear medicine, radiation biology, radiochemistry, food-irradiation, nuclear powered agro-industrial complex, nuclear desalination

etc, are well known examples. It is likely that in the years to come more and more such interdisciplinary subjects will emerge. Due to this quality inherent in the basic structure, there will be a constant widening of the user circle and on account of the evolution of unpredicted relationships between subjects, units of information once deemed beyond the scope might fall within the ambit of the subject at a later date (1).

22 Bhabha Atomic Research Centre, Trombay

The Bhabha Atomic Research Centre (BARC) at Trombay is the national centre for research in and development of, atomic energy for peaceful purposes. The information needs of about 6,500 scientists, engineers and technicians of the Centre are met by its Library and Technical Information Section (L & TIS). The Library has some 63,000 books and bound volumes of periodicals in the nuclear science field and it subscribes to some 1,200 scientific and technical periodicals. Its Depository Unit has a collection of about 190,000 scientific and technical reports of the various atomic energy organisations in the world, and annually some 16,000 new reports are added to it.

The L & TIS subscribes to sixty two indexing and abstracting periodicals.

23 Criteria Used for Procurement

The L & TIS procures Indexing and Abstracting periodicals, on the basis of the following criteria:

1 How extensively a particular subject field has been covered;

2 Will it be largely referred to by the scientists working in the particular subject field alone;

3 How helpful it is for the development activities of the particular section and in general for BARC;

4 Whether the same subject has been covered in a more broader indexing or abstracting periodical already subscribed to by L & TIS; and

5 The publisher's reputation, the utility of indexes, quality of abstracts, frequency and regularity in publication etc.

All the sixty two indexing and abstracting periodicals subscribed to by the L & TIS are used by the BARC scientists. But the most frequently used ones are only about ten as indicated in the questionnaire (See Appendix 1 in Sec 92).

24 Budget Allocation

The total budget of the library for the current year is Rs 8.6 lakhs of which nearly half is allocated for subscription to periodicals and membership. The sixty-two indexing and abstracting periodicals cost about Rs 50,000. Thus, ratio of the expenditure on indexing and abstracting periodicals to that on other periodicals is about 1:8. The indexing and abstracting periodicals range from very the highly priced -- such as Chemical abstracts ($1967) to those received on the basis of bilateral agreements for

exchange of publications (some eight such periodicals are received).

25 Service

The indexing and abstracting periodicals are given a special treatment in the L & TIS. A few important and frequently used indexing and abstracting periodicals are arranged in broken sequence and shelved separately, alphabetically by their respective titles. The cumulative indexes are arranged separately from the current volumes to aid retrospective search. The remaining indexing and abstracting periodicals are arranged alphabetically according to their titles along with the primary periodicals received. None of these periodicals are issued out of the library.

3 USE OF INDEXING AND ABSTRACTING PERIODICALS

The BARC scientists are specialists in their respective subjects and make extensive use of the library facilities. Some of the readers have made suggestions for the development of the L & TIS. Out of the sixty two indexing and abstracting periodicals currently received in the L & TIS, it is interesting to note that about 30 are subscribed on the basis of the suggestion of the users. Of course, the announcements regarding any such new periodical is brought to their notice, along with other publications.

On an average about 300 scientists visit the library daily of whom 20-30 scientists refer to the indexing and abstracting periodicals. For, the

past few years, particularly after the reorganisation and centralisation of the library in 1967-68, it is found that the number of requests for procurement of documents not available in the library has been gradually increasing. The number of such requests originating from the references published in the indexing and abstracting periodicals is also increasing. The number of requests processed for procurement of the documents depending upon the scanning and referring of the indexing and abstracting periodicals by the BARC scientist, can be taken as an index of the extent of utilisation of the indexing and abstracting periodicals in the L & TIS.

31 Findings of Survey

With the object of assessing the extent of the utilization of the indexing and abstracting periodicals by the BARC scientists and engineers, a questionnaire (See Appendix 1) was designed and sent to the users of the library facilities to enable them to communicate their views in the form of answers to specific questions. Besides, personal interviews were also conducted at random. Nine important indexing and abstracting periodicals were included for the purpose of this survey. Although the number of scientists referring to indexing and abstracting periodicals is small, those who refer do so very regularly. The reason for non-utilization by others may be due to lack of awareness of the real advantages of using secondary periodicals. The survey also indicated that those

who consult the indexing and abstracting periodicals refer to more than one such publication in their subject field. The reasons, explained by them, seems to be that it will enable them to cover their subject field more extensively, including all types of documents published. The opinion of the users seems to be unanimous in respect of the maximum utilization of the NSA and CA. The remaining seven indexing and abstracting periodicals are used comparatively less, only by the specialists working in a special subject field. Among the indexing periodicals received, Current contents, including all the parts, has the maximum utilization.

4 EVALUATION OF INDEXING AND ABSTRACTING PERIODICALS

41 Selection of Periodicals for Study

Though Chemical abstracts, Analytical abstracts, Biological abstracts, and Metallurgical abstracts are also used by the chemists, chemical engineers, bio-chemists, biologists, metallurgists etc, working in the BARC, for our critical study, however, we intend to cover only those periodicals which directly deal with nuclear science and technology, and used most frequently in the L & TIS. They are:

1 Nuclear science abstracts (U S Atomic Energy Commission).

2 INIS Atomindex (International Atomic Energy Agency, Vienna).

3 Science abstracts. Section A; Physics abstracts

4 Science abstracts. Section B: Electrical and

electronics abstracts (Institution of Electrical Engineers, London, and Institute of Electrical and Electronics Engineers, Inc, New York).

5 Scientific and technical aerospace reports (STAR) (National Aeronautics and Space Administration, U S A).

6 U S Government research and development reports (National Technical Information Service, USA).

7 Information zur kernforschung und kerntechnik (Formerly AED-AB) (Zentralstelle fur Atomkernenergie-Dokumentation (ZAED), W Germany).

42 Criteria for Evaluation

Generally, all the abstracting periodicals in nuclear science and technology are published by national or international atomic energy organisations or publishers of international repute. They aim at being comprehensive in their respective subject fields and claim to have a very useful procedure for their indexing, subject break-up, lay-out and format, abstracting etc. Our study of the indexing and abstracting periodicals, particularly those received in the L & TIS, and their utilization by the BARC scientists reveals that though a uniform procedure is followed by a periodical, there is non-uniformity among them in respect of slant to specific subject fields. An effort is made here to study the abstracting periodicals which are used very frequently by the BARC scientists. The following

criteria were considered:

1 Subject coverage;
2 Type of documents covered;
3 Indexes;
4 Abstract;
5 Time-lag;
6 Arrangement of entries in individual issues;
7 Bibliographical information; and
8 General layout and format.

5 FINDINGS REGARDING COVERAGE AND INDEX

51 Subject Coverage

511 Nuclear Science Abstracts

The abstracting periodicals considered are mainly devoted to nuclear science and technology, but their emphasis on specific subjects differs. The Nuclear science abstracts (NSA) has a very exhaustive coverage of the subject and is the most important abstracting periodical in the nuclear field. It is hospitable to new subjects emerging from time to time. The subjects covered by it is helpful in knowing the range of nuclear science and technology.

512 Physics Abstracts

Physics abstracts (PA) and Electrical and electronics abstracts (EEA), though not completely devoted to nuclear science, do cover a large number of documents on nuclear science. PA includes atomic and nuclear physics, plasma physics and related subjects, whereas EEA includes nuclear engineering and nuclear power,

energy conversion, particle accelerator, thermonuclear device, radiation counter and detector and other instruments.

513 Other Services

Information zur kernforschung und kerntechnik (ZAED-IKK) includes nuclear engineering. Its coverage of reactor technology and nuclear power plants is particularly extensive. Scientific and technical aerospace reports (STAR), as its name implies, covers the science and technology of space and aeronautics and includes nuclear powered air-craft, nuclear ship propulsion, reactor technology, data processing etc. For BARC scientists, the STAR is also useful for its coverage of seismology, nuclear tests, geophysics, astrophysics, metereology etc. The INIS Atomindex (AI) now has a very limited subject scope which excludes most of chemistry, nuclear physics etc. When it starts covering all the subject in the field, probably it will be a very comprehensive source of information in nuclear science and technology because its scope is defined by the active participation of national and international organisations in the field of atomic energy. Its subject coverage is flexible and may include or delete a subject category based upon its utilization by the national atomic energy centres. It is hoped that INIS will eventually have a better subject coverage of nuclear science and technology than the present NSA.

52 Division of Subject

To bring together the abstracts of documents on related subjects, abstracting periodicals divide the

subject into smaller groups usually based on the study of scientific disciplines and their developments and not by any classification scheme having a theoretical base for subject classification. The number of subject groups varies from a minimum of six to a maximum of eighty depending on the respective subject coverage of abstracting periodicals. Thus Atomindex has 6, STAR has 34, CA has 80, NSA has 10, USGRDR has 22 subject groups which are further divided into narrower sub-groups. The PA and EEA are the only periodicals using a scheme for classification, namely, Universal Decimal Classification (UDC). The PA uses subject headings following the UDC but doesnot use its notation whereas the EEA uses both the classification and its notation. However, recently both PA and EEA have a subject break-down which is not based on UDC. The ZAED-IKK uses subject groups referred by ordinal numbers from 0 to 9 and each is further divided similarly. The scope of each major group and its sub-group also differs and has an orientation towards the broader subject. When one subject group, say, reactor technology is covered by the NSA, EEA, ZAED-IKK, PA, STAR and AI, the scope differs in all of these periodicals. For engineering aspects of nuclear science, Nuclear engineering abstracts, (not received by the L TIS) is worth mentioning.

53 Type of Document

Scientific information is published in various kinds of documents-- such as, report, article in periodical, conference paper, patent, and standard.

70

There are variations among the abstracting periodicals in respect of the coverage of such documents. The NSA has a very good coverage of the technical reports published by the US Atomic Energy Commission and various other atomic energy organisations of the world. In 1946, it was published as U S Government declassified reports covering only the U S Government reports, but the scope was extended in 1947, with the change in the title, to include reports published by other atomic energy centres in the world. The USGRDR announces reports of U S Government sponsored research and development reports released to the public through the National Technical Information Service of the US Atomic Energy Commission, Department of Defence (DOD), NASA and other U S Government Departments and agencies. The PA and EEA have a better coverage of articles in periodicals, particularly those from Europe. The STAR covers reports produced by the NASA through its various contracts. It also covers other reports from various learned societies and organisations coming within its scope. Papers presented at various symposia, conferences etc, are covered extensively by NSA and it assigns a report number with prefix CONF. The ZAED-IKK also has a comprehensive coverage of conferences in its monthly abstracting periodical Informationen zur kernforschung und kerntechnik which announces conference papers obtained by the ZAED from all over the world. It also includes dissertations from German universities and research reports of German institutions and organisations. The INIS Atomindex has a balanced coverage of all types of documents as it includes all that is

published and processed by the various INIS in-putting centres of the world. Until now translations and patents have been excluded from INIS Atomindex, but these will be included in the near future after effecting necessary improvements in the system.

54 Index

Indexes are provided by the indexing and abstracting periodicals to facilitate reference and to give additional approach points other than the one in which the bibliographic entries are arranged. There are variations in the kind and the number of indexes provided by the abstracting services. Many of them have adapted to computer-produced indexing. Most common indexes are personal author index, corporate author index, subject index, and report number index. The indexes are supplied with each individual issue and in many cases cumulated quarterly, semi-annually, annually and in certain cases after five years and ten years.

541 Subject Index

As subject approach is the most common approach of users, almost all the abstracting periodicals provide a subject index. The indexing periodicals, however, compensate this by providing a computer-produced keyword in context (KWIC), keyword out of context (KWOC), or wrap-around type of permuted title index. Such a type of indexes can be produced comparatively quickly. Those providing a subject index usually have controlled vocabulary for the index terms or descriptor, such as, a thesaurus or descriptor list.

The NSA uses the USAEC subject headings (5); STAR uses the NASA thesaurus; PA and EEA used controlled list of current subject headings; and ZAED-IKK use the ZAED discriptor list. The INIS Atomindex uses broad subject headings for the individual entries to group similar subjects but has not yet provided any index.

All the periodicals considered use modifiers with phrases explaining the salient points from the content of the original document. But the NSA, the PA, and the EEA arrange the modifiers alphabetically as a further aid in reference, whereas the STAR having more informative phrases under the indexed specific subject terms, does not arrange them in that way. The ZAED-IKK has a computer-produced subject index and its modifiers preceded by a hyphen under each descriptor are arranged alphabetically. The USGRDR provides the subject index using the descriptors and identifiers appearing in all the bibliographic entries within parenthesis and also preceded by an asterisk. The USGRDR, identifiers are specific subject terms and not phrases as in the NSA and other abstracting periodicals.

542 Report Number Index

The published scientific and technical reports are generally assigned a report number by the issuing organisation. The report number, also known as designator, usually includes a report series code and identifier made up of arbitrarily chosen letters and a serial number respectively. This report number becomes the unique number to identify a particular report. The NSA, STAR and USGRDR provide a report number

index. The NSA report number index gives information about the availability, the physical form, such as full-size, microfilm, microfiche, and also price of each report, along with reference to its abstract number. Under CONF, all the conferences indexed and abstracted with their CONF number followed by the full title of the conference with place and date of the conference are given. Patents are indexed like reports using the word, 'Patent' followed by an adjectival form of the name of the country. The cumulated report number indexes give an alphabetical list of all report series codes with information on the issuing organisation and the numbering system.

The STAR has report number-accession number index where each report number is referred to the NASA accession number. The report number index part 1 of the EEA and the PA index are arranged alphabetically according to the name of the issuing organisation in bold type followed by the report number, short title, and abstract number.

543 Author Index

Abstracting periodicals invariably give an alphabetically arranged author index -- both personal author and corporate author. Indexing periodicals also provide such an index, for it can be easily produced with the aid of computer.

544 Number of Indexes

The variations in the kind and number of indexes are summarized in Table 1. For a comprative study,

the CA and BA are included. It is evident from Table 1 that the types of indexes and the number of indexes depend upon the subject and the type of documents covered in an abstracting periodical.

Table 1. Abstracting Periodicals and the Type of Indexes provided
P = Provides

Index	Periodical							
	BA	CA	EEA	NSA	PA	STAR	USGRDR	ZAED-IKK
Acces N / Report N						P	P	
Author	P	P	P	P	P	P	P	P
BASIC[1]	P							
Bibliography			P		P			
Book			P		P			
Biosystematic[4]	P							
Conference			P		P			P
- Date - Number - Place								P
Contract N / Acces N						P		
Contract N / Grant N							P	
CROSS[2]	P							
Formula		P						
HAIC[3]		P						
Patent Concordance		P						
Registry N		P						
Report N			P	P	P		P	P

Index	Periodical							
	BA	CA	EEA	NSA	PA	STAR	USGRDR	ZAED-IKK
Report N / Acces N						P		
Ring System		P						
Subject	P	P	P	P	P	P	P	P
Patent N		P	P		P			
Total	4	8	7	3	7	5	5	5

Abbreviations Used

N = Number

1 BASIC = Biological Abstracts Subject in Context

2 CROSS = Computerized Rearrangements of Special Subjects

3 HAIC = Hetero-Atom-In-Context Index

4 Bio Systematic = Groups all studies, regardless of their methodology according to taxonomic positions of organisms.

6 FINDINGS REGARDING ABSTRACT

61 NSA gives informative abstracts for technical reports and articles in periodicals. The abstracts of 'annual reports' of the atomic energy organisations are more informative in summarizing each new development and result. Occasionally, author's abstracts are reproduced. Indicative abstracts are used for book, conference proceedings, and review documents reviewing or surveying a particular subject field.

When necessary, particularly in reactor physics, the mathematical equations are also included with explanation for each variable and constant used in the equation. In some cases, for a very comprehensive document on a broader subject, the contents are enumerated in the abstract.

62 ZAED-IKK has a different method of abstracting. Its abstracts are short, describing the salient features using phrases from the document, and not sentences. The phrases are written one after the other, each beginning with a hyphen.

63 STAR abstracts are generally of the indicative type for comprehensive treatises, and of the informative type for reports and articles in periodicals. The contents of the original document are enumerated in some cases. INIS Atomindex does not provide abstracts, but they are made available on microfiche which can be reproduced using a reprographic equipment, such as a Rank Xerox 1824 Printer. The abstracts are informative for most of the reports and articles in periodicals.

64 A number of examples can be found through the annual indexes where one and the same document is abstracted by NSA, STAR, ZAED-IKK etc, clearly indicating their respective slants.

65 There is a unique procedure of abstracting followed by the Nuclear engineering abstracts. It has long and detailed abstracts and in some cases amounting almost to an analysis of the information

77

contained in the original document . If, for example, four papers are published on a subject at the same time, the abstract considers all the four together, noting the salient points of each and treating them comparatively. Such an approach is helpful for the user seeking current information. However, this kind of abstracting requires special abilities on the part of the abstractor.

7 TIME LAG

Time-lag is the time elapsing between the publication of a document and its mention in an indexing or abstracting periodical. Greater the time-lag, less useful may the indexing or abstracting periodical.

The abstracting periodicals take comparatively more time for compilation than the indexing periodicals. It is usually estimated as six months or more for abstracting periodicals and three or more for indexing periodicals. Particularly for documents published in India, the time-lag is less with NSA compared with Chemical abstracts, PA and EEA. The recent developments in abstracting and indexing periodicals are towards reducing the time-lag and new mechanical methods are being used for some of the procedures in the compilation of indexing and abstracting periodicals. The periodicals aiming at alerting the scientists by providing current awareness service, in fact try to overcome the time-lag and announce the articles to be published in forthcoming issues of the selected periodicals devoted to a particular subject field.

Amongst all the indexing and abstracting periodicals, the INIS Atomindex is the fastest as the time-lag is almost reduced to one month for the index with simultaneous abstracts on microfiche. It uses a computer-based facility and a decentralized input for the centralized system.

8 OTHER FEATURES

81 Arrangement in Individual Issues

The arrangement of the entries in the individual issue of an abstracting periodical follows the subject division adopted by it. Each issue contains the indexes after the bibliographic entries. All broad subject groups are further divided into narrower subject groups. INIS Atomindex arranges entries under each subject heading alphabetically by name of author. For reference on a particular subject, the NSA arrangement has been found more satisfactory by the BARC scientists.

82 Bibliographical Information

The amount of bibliographical information given for each document is maximum in NSA, STAR and INIS Atomindex whereas in ZAED-IKK, PA and EEA it is sufficient to identify a document. There are variations in the sequence in which the items of information are given. INIS Atomindex has full bibliographical information for each type of document according to the prescribed rules for descriptive cataloguing (4).

83 General Layout and Format

The general layout and format of an abstracting

periodical should be attractive, using suitable typography and indentations for convenient reference. Each issue should have explanatory notes of the subject divisions, arrangement of entries, abbreviations used etc. Almost all the periodicals considered have such a layout, format, and features. The NSA layout and format, however, has been found most satisfactory by our scientists.

91 BIBLIOGRAPHICAL REFERENCES

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3 Sec 11 --. Science since Babylon. 1961.
13 Chap 5, p 92-124.

4 Sec 82 ATOMIC ENERGY (International —Agency)(Vienna) INIS: descriptive cataloguing rules. IAEA-INIS-1 (Rev 1) 1970.

5 Sec 541 UNITED STATES. ATOMIC ENERGY (- Commission). TECHNICAL INFORMATION (Division of -). Subject headings used by USAEC Division of Technical Information. Ninth rev. 1969. (TID-5001).

92 APPENDIX 1

Utilization of Indexing and Abstracting Periodicals by BARC Scientists: A Survey.

Name (Not essential if preferred):

Division :

Subject/s of interest :

Please mark the appropriate columns for the indexing and abstracting periodical/s you refer.

SN	Periodical	Frequency you refer		Individual issue.	Cumulated index
		Weekly	Monthly		
1	Atomindex, INIS				
2	Biological Abstracts (BA)				
3	Chemical Abstracts (CA)				
4	Current Contents (CC)				
5	Electrical and Electronics Abstracts (EEA)				
6	Information on Nuclear Science and Technology, ZAED				
7	Nuclear Science Abstracts (NSA), USAEC				
8	Physics Abstracts (PA)				
9	Scientific and Technical Aerospace Reports (STAR), NASA				
10	Others				

31

Please circle the serial numbers of the periodicals against each of the following criteria that satisfy your approach.

	1 AI	2 BA	3 CA	4 CC	5 EEA	6 ZAED	7 NSA	8 PA	9 STAR	10
1 GENERAL										
1.1 The subject of my interest is covered extensively in the periodical	1	2	3	4	5	6	7	8	9	10
1.2 The literature coverage of documents such as reports, periodical articles, books, standards, patents etc, is extensive.	1	2	3	4	5	6	7	8	9	10
1.3 The typography and format of entries of documents, indexes etc, are convenient for reference and attractive.	1	2	3	4	5	6	7	8	9	10
2 INDIVIDUAL REGULAR ISSUES OF THE PERIODICALS										
2.1 The entries for documents are grouped under different broad subject fields which bring together entries of my subject interest.	1	2	3	4	5	6	7	8	9	10

2.2 The entries for documents within a broad subject field are further arranged in the narrower subject fields to identify and locate entries of documents of my subject interest specifically. 1 2 3 4 5 6 7 8 9 10

2.3 Each entry for document contains bibliographic information such as author, title, volume N, issue N, pages, date of publication, report N, contract N, etc, to identify and locate the documents in the library 1 2 3 4 5 6 7 8 9 10

3 INDEXES

3.1 Each issue of the periodical contains indexes such as author, report, subject, keyword index etc, to identify and locate pinpointedly a document of my interest. 1 2 3 4 5 6 7 8 9 10

3.2 The index terms used in the subject index are specific narrower subject terms of current usage in the subject field of my interest and help in locating most of my subject queries. 1 2 3 4 5 6 7 8 9 10

3.3 The arrangement of entries under specific index terms helps to scan and identify a further narrower aspect of the subject 1 2 3 4 5 6 7 8 9 10

4 ABSTRACTS

4.1 The abstracts are adequate to let me know the subject content of the original and help to guide me to know whether the original document is of my interest. 1 2 3 4 5 6 7 8 9 10

5 EXPERIENCE

5.1 Have you come across any incidence when a particular indexing and abstracting periodical was of very significant help to you? YES/NO

5.2 If yes, please state in your own words the index term you referred and your esperience.

6 REMARKS, IF ANY:

DRTC Seminar (9)(1971). Paper AD.

ABSTRACTING AND INDEXING PERIODICALS IN TEXTILES AND ALLIED SUBJECTS.

P C SHAH, Librarian, Ahmedabad Textile Industry's Research Association (ATIRA), Ahmedabad 15.

/Information about selected abstracting, indexing, and reviewing periodicals in textile science and textile technology and related subjects is given. Two of the leading abstracing periodicals are compared. Coverage of Indian periodicals on textiles in the World textile abstracts and Indian science abstracts is examined. ATIRA's abstracting and indexing services is compared with the World textile abstracts. Limitations of ATIRA's abstracting and indexing services are pointed out. The system implemented by ATIRA Library by making use of the World textile abstracts to facilitate a more complete retrospective search is discussed./

1 INTRODUCTION

11 Abstracting and Indexing Periodicals

The growing volume of research publications and increasing atomisation of the field of research, demands that the research worker be supplied, pinpointedly and expeditiously, with the nascent ideas so as to avoid wastage of research potential that may arise from unintended and unnecessary duplication. The abstracting and indexing periodicals are aids in achieving this. The abstracting and indexing periodicals are helpful in alerting the research worker about the original papers published in primary periodicals, and also in retrospective search. There

are some five thousand abstracting and indexing periodicals covering the field of science and technology.

12 Scope of the Paper

This paper examines some of the abstracting periodicals in textile science and technology. The emphasis is on the current publications of this type.

2 ABSTRACTING, INDEXING, AND REVIEWING PERIODICALS IN TEXTILES AND ALLIED SUBJECTS

21 Abstracting and Indexing Periodical

A list of selected abstracting and indexing periodicals, useful to textile technologists, is given in Sec 23. Some give indicative abstracts, others provide informative abstracts, and still others are bare documentation lists.

22 Reviewing Periodicals

Reviewing periodicals which present state-of-art and trend reports on specific subjects in the field are of considerable value to the research worker, technologist, production engineer, and manager. Evaluative or critical reports by specialists in the subject are sought after by other specialists. A list of these reviewing periodicals is also given at the end of Table 1 in Sec 23.

Table 1. List of Abstracting, Indexing, and Reviewing Periodicals

SN	Title, Year of Commencement, Frequency of Publication	Arrangement of entries, Indexes
	1 Abstracting/Indexing periodicals essentially devoted to Textile Technology	
1	Bulletin de l'Institut Textile de France (Documentation Section) 1947 -. Bimonthly. L'Institut Textile de France, Paris	Arranged under broad subject headings. Author and subject indexes. Keywords for each abstract.
2	Bulletin of the Scottish Textile Research Association. Quarterly. Scottish Textile Research Association, Dundee, Scotland	Arranged under subject headings. Author and subject indexes. Keywords for each abstract
3	Current Textile Literature with Abstracts 1964 -. Bimonthly. ATIRA, Ahmedabad 15.	Arranged under subject headings.
4	Hosiery Abstracts 1949 -. Bimonthly. Hosiery and Allied Trades Research Association, Nottingham, UK.	Arranged under subject headings.

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SN	Title, Year of Commencement, Frequency of Publication	Arrangement of entries, Indexes
5	Investigacion e Informacion Textil (Documentation Section) 1958 -. Monthly. Instituto Textil de Curtidos del Centro de Investigacion y desarrollo, Barcelona.	Arranged under subject headings
6	Journal of the Society of Dyers and Colourists (Abstracts Section) 1884 -. Monthly. The Society of Dyers and Colourists, Bradford, UK.	Arranged under subject headings. Annual Author, Subject, and Numerical Patent indexes.
7	Textile Technology Digest. 1944 -. Monthly. Institute of Textile Technology, Charlottesville, USA.	Arranged under subject headings. Annual Author, Subject and Numerical Patent indexes
8	Textracts Monthly. J B Goldberg, New York, USA.	Mainly extracts from commercial and techno-commercial news of the textile industry, with a few patent abstracts.

Shah

SN	Title, Year of Commencement, Frequency of Publication	Arrangement of Entries, Indexes
9	World Textile Abstracts. 1969 -. Fortnightly. Shirley Institute, Manchester, UK.	Arranged under subject headings. Annual Author, Subject, and Numerical Patent indexes Single side printed copy available

2 Abstracting/Indexing Periodicals devoted to Chemistry and Chemical Technology, but covering some aspects of Textile Technology also

1	Analytical Abstracts 1954 -. Monthly. W Heffer and Sons Ltd, Cambridge, UK	Analytical chemistry of polymer, fibre, dye, and other textile chemicals. Arranged under subject headings Annual Author and Subject indexes.
2	Chemical Abstracts 1907 -. Weekly. American Chemical Society, Easton, USA.	Arranged under 80 sections of which four are of prime importance to textile chemists: N 39 - Textiles; N 40 - Dyes; fluorescent whitening agents, and photosensitizers;N 43 - Cellulose; lignin, paper and other wood products; N 46 - Surface active agents and detergents. Arranged under subject headings. In each issue Keyword, Subject indexes; Numerical patent index, Patent concordance, and Author index.

SN	Title, Year of Commencement, Frequency of Publication	Arrangement of entries, Indexes

3 Abstracting/Indexing Periodicals covering Natural Sciences in general but also including some aspects of Textile Technology

1	Applied Science and Technology Index 1958 -, Monthly. H W Wilson Co, New York.	Covers several textile periodicals. Arranged under Subject headings. Annual cumulations.
2	Indian Science Abstracts 1965 -, Monthly. INSDOC, New Delhi, India.	Covers articles, patents, etc on textiles published in India. Classified by UDC. Annual Author and Keyword indexes.
3	Search 1964 -, Monthly. Compendium Publishers International Corporation, New York, USA.	Reviews and abstracts. Issued in several divisions, separately available, such as, textiles, dyes, pigments and coatings. Cumulative monthly Subject index.

4 Abstracting/Indexing Periodicals devoted to Engineering and related subjects but covering the engineering aspects of textile production

1	Engineering Index 1928 -, Monthly (after Oct 1962). Annual volume Engineering Index Inc, New York, USA	All aspects of textile engineering Arranged under subject headings Author index

SN	Title, Year of Commencement, Frequency of Publication	Arrangement of entries, Indexes
2	Packing Abstracts 1944 -. Monthly. Research Association for the Paper and Board, Printing and Packing Industries, Leatherhead, UK.	Includes textiles as packing materials, textile sacks, and the packaging of textiles and clothing. Arrangement by subject headings. Annual Author and Subject indexes.

5 Abstracting/Indexing periodicals covering the business and economic aspects of textile industry

1	Business Periodical Index 1958 -. Monthly. H W Wilson Co, New York, USA	Covers economics and business aspects of textiles published in non-textile periodicals Annual cumulations
2	Chemical Market Abstracts 1950 -. Monthly Chemical Horizons Inc, New York, USA	Covers textile and related industries. Arranged under subject headings. Current and cumulated indexes.

SN	Title, Year of Commencement, Frequency of Publication	Arrangement of entries, Indexes
	REVIEWING PERIODICALS	
1	Review of Progress in Colouration and Related Topics 1969 -. Annual. Society of Dyers and Colourists, Bradford, UK.	
2	Review of Textile Progress: A Survey of World Literature. 1949 -. Annual. The Textile Institute, The Society of Dyers and Colourists, and Butterworth and Co, Ltd. UK.	Chapters devoted to different sections of the textile science and textile industry. Extensive references and footnotes. Name and Subject indexes.
3	Textile Progress 1969 -. Annual. The Textile Institute, Manchester, UK.	Critical evaluation of documents by subject specialists. Comprehensive bibliography in each issue Author index and Keyword index

3 COMPARISON OF TWO ABSTRACTING PERIODICALS

In the succeeding sections, data are presented about World textile abstracts (WTA) and Textile technology digest (TTD).

31 Table 2. Country-wise Coverage of Periodicals

Country	N of periodicals covered in 1970		Country	N of periodicals covered in 1970	
	WTA	TTD		WTA	TTD
Africa	4	4	Netherland	8	6
Argentina	1	3	New Zealand	6	1
Australia	8	7	Norway	3	-
Austria	1	-	Pakistan	3	2
Belgium	4	5	Peru	1	-
Canada	11	5	Poland	6	5
Czechoslovakia	5	4	Portugal	2	1
Denmark	2	1	Romania	3	2
France	30	17	Spain	4	3
Germany	37	22	Sweden	5	2
Great Britain	243	66	Switzerland	18	14
Hungary	4	9	U S A	135	236
India	14	14	U S S R	14	4
Ireland	1	1	West Indies	1	-
Italy	7	10	Yugoslavia	1	1
Japan	13	17	Total	596	462
Mexico	1	-			

32 Table 3. Total Number of Abstracts

Abstr per	1969			1970		
	Abstracts of		Total	Abstracts of		Total
	Papers	Patent specif		Papers	Patent specif	
WTA	5406	2324	7730	5745	2989	8734
TTD	8313	4188	12501	8009	4512	12521

93

33 Table 4. Subject-wise Coverage

SN	Subject	Abstr per	Abstr in 1969 of			Abstr in 1970 of		
			Pa-pers	Pa-tents	Total	Pa-pers	Pa-tents	Total
1	Fibre	WTA	876	349	1225	939	1086	1391
		TTD	1137	599	1736	1086	645	1731
2	Yarn	WTA	610	490	1100	571	593	1164
		TTD	846	666	1512	804	569	1373
3	Fabric	WTA	913	710	1623	848	955	1803
		TTD	1884	1308	3192	2130	1436	3566
4	Finish-ing	WTA	1310	639	1949	1464	848	2312
		TTD	1801	372	2673	1699	977	2676
5	Apparel	WTA	316	121	437	333	127	460
		TTD	716	689	1305	635	820	1455
6	Analysis, Testing Quality Control	WTA	528	15	543	670	14	684
		TTD	684	39	723	565	50	615
7	Mill Manage-ment Prod Eng	WTA	364	76	440	375	-	375
		TTD	715	15	730	703	13	716
8	Science (gene-ral)	WTA	465	-	465	473	-	473
		TTD	101	-	101	93	2	95
9	General topics	WTA	69	-	69	72	-	72
		TTD	429	-	429	295	-	295

94

34 Table 5. Average Number of Abstracts per page

Abstracting Periodical	Total N of Papers		Total N of Abstracts	
	1969	1970	1969	1970
WTA	1376	1646	7730	8734
TTD	886	788	12501	12521

The average number of abstracts per page in WTA is 5.5, whereas it is 15 in TTD. That is, the abstract is comparatively longer in WTA. While WTA covers more periodicals, the total number of abstracts per year is larger in TTD.

4 RELATED ABSTRACTING SERVICES

Some of the abstracting services devoted to subjects other than textile technology have sections of interest to the textile technologist. Three of these services with the corresponding sections in WTA are mentioned below.

Abstracting/Indexing Service	Corresponding Section of WTA
Engineering Index (= EI)	Mill Engineering
Journal of the Society of Dyers and Colourists (=JSDC)	Chemical and Finishing Processes
Chemical Abstracts (=CA) Sections, 39, 40, 43 and 46	Chemical and Finishing Processes

41 Number of Periodicals Covered

WTA	EI	JSDC
596	2205	104

95

42 Coverage of Common Periodicals

WTA and EI	WTA and JSDC
109	72

5 COVERAGE OF INDIAN TEXTILE PERIODICALS IN WTA AND IN INDIAN SCIENCE ABSTRACTS

There are 153 periodical publications on textiles published in India. Of these, 10 are abstracted in the Indian science abstracts. Fourteen Indian periodicals are covered by WTA. The Indian science abstracts should include more textile periodicals published in India.

6 ATIRA'S ABSTRACTING AND INDEXING SERVICES

ATIRA Library started abstracting and indexing services in 1965. Upto 1970, ATIRA library has abstracted 3,125 scientific and technical articles -- that is, on an average, 520 articles per year. Table 6 presents comparative data by number of abstracts.

61 Table 6. Number of Abstracts

Abstracting Service	1965 to 1970
World Textile Abstracts (Previously Textile abstracts)	42,761
ATIRA's Abstracting and Indexing Services	3,125

62 Table 7. Subject-wise Coverage

SN	Subject	N of Abstracts (1965 70)
1	Fibre production and properties ..	55
2	Yarn production and properties ..	204
3	Fabrics production and properties ..	220
4	Chemical and finishing processes ..	772
5	Analysis, testing and quality control	527
6	Mill management including production engineering ..	653
7	Science	625
8	General	69

63 Table 8. Number of Periodicals Abstracted

SN	Particulars	N
1	Number of periodicals abstracted in World textile abstracts.	596
2	Number of periodicals received by ATIRA library	343
3	Number of periodicals received by ATIRA library out of 596	126
4	Number of periodicals abstracted by ATIRA out of 343	76
5	Number of periodicals abstracted by ATIRA out of 126, that is, pericdicals abstracted by both ATIRA and WTA	48
6	Number of periodicals abstracted by ATIRA, but not abstracted in WTA (4-5)	28
7	Number of periodicals abstracted in WTA, but not abstracted by ATIRA (1-5)	548
8	Number of periodicals received by ATIRA, but not abstracted in WTA (2-3)	217
9	Number of periodicals not received by ATIRA, but abstracted in WTA (1-3)	470

97

64 Observation on ATIRA's Abstracting and Indexing Services

1. It is severely selective.

2 It abstracts less than 10 per cent of the total of all documents in textile technology and hence comprehensive retrospective literature search is not possible with this service.

3 It is confined to the resources available within the ATIRA library.

4 Receipt of a primary periodical by surface mail increases the time-lag in the preparation of ATIRA abstracts.

65 Observations on WTA

1 One-side printed copy of WTA is available by air mail.

2 If copies of WTA are obtained by air mail, in most of the cases, the published abstract would be received by ATIRA earlier by WTA than by ATIRA abstracts, as the primary periodicals are received by surface mail.

3 The abstracts published in WTA are adequate.

4 For a complete retrospective search, the research worker has to use WTA in any case.

7 NEW SYSTEM OF SERVICE

In order to minimise the wastage of the research worker's time and effort, ATIRA has implemented the following system from January 1971:

1 Subscribe to an air mail copy of the one-side printed WTA.

2 Each abstract is cut and pasted on a 6" x 4" catalogue card.

3 The abstracts are classified and arranged according to the classification scheme prepared by ATIRA library.

4 Patents are arranged country-wise and then numerically under broad subject headings.

5 Uniterm indexing system is used in document search.

6 Abstracts, whose original complete articles are available in the ATIRA library are marked with (*) asterisk.

7 The abstracts, which are useful to technologists of the textile mills, are marked with (+) and they are reproduced in the library bulletin Current textile literature with abstracts.

8 We also plan to collect and arrange in a classified sequence in a Central Information Index all the abstracts published in WTA for a period of five years. After five years, all the abstracts will be typed in a classified sequence. These will form subject bibliographies covering successive 5-year periods beginning 1971-75. To ensure exhaustive coverage of the field of textiles and allied subjects in our Current information index, the following will be checked:

Textile technology digest, Engineering index, Chemical abstracts, and Journal of the Society of Dyers and Colourists.

9 The periodicals, which are not covered by WTA and received by the ATIRA library will be abstracted and

99

indexed according to the system described earlier (1).

8 ACKNOWLEDGMENT

I am grateful to Dr P C Mehta, Director, ATIRA, for permission to contribute this paper to the DRTC Seminar (9)(1971).

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DRTC Seminar (9) (1971). Paper AE.

"BULLETIN OF PEACE PROPOSALS": AN EVALUATION.

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/The Bulletin of peace proposals -- a new variety of abstracting periodical -- is evaluated in respect of its subject coverage, document coverage, structure of an entry, type of abstract, grouping and arrangement of the abstracts, and standard for bibliographical reference. The commendable features of the Bulletin are highlighted and some suggestions are made in regard to the classification of subjects, formulation of subject headings, and adoption of standard practice for bibliographical reference/.

1 "BULLETIN OF PEACE PROPOSALS"

11 Genesis

The Bulletin of peace proposals, a quarterly abstracting periodical, - is the result of an effort by the International Peace Research Association, Groningen, and other similar organisations interested in the promotion of peace and dispensation of justice. The objective is "to motivate research, to inspire future oriented thinking, and to promote activities of peace". The Bulletin is edited by the International Peace Research Institute, Oslo, under the auspices of the International Peace Research Association, Groningen. It received financial support from the Nordic Cooperation Committee in International Relations, including Conflict and Peace Research, the Institute for International

Order, New York, the Aquinas Fund, New York, and the Norwegian Committee for Arms Control and Disarmament. The Bulletin is published by the Universitetsforlaget, Oslo. Two mimeographed issues of the Bulletin were brought out in 1969, and the first printed issue was published early in 1970.

12 Warmly Welcomed

The publication of the Bulletin is timely. For a variety of reasons, there is a growing anxiety among leaders and statesmen, scholars and lovers of peace about and the need to intensify measures designed to promote, peace and dispensation of justice. The dissemination of information about proposals and statements, directly or indirectly influencing the promotion of peace in the world is an essential step in helping research on "peace" and better understanding among the people, intranational and international. Therefore, the Bulletin has received a warm welcome from scholars, statesmen and others. Chadwick F Alger, Professor of Political Science, Northwestern University, Illinois, writes: "... A very creative way for stimulating the application of peace research and social sciences in general ..." Giovanni Maria Di Simone, Director, IREA, Rome, says : "... an outstanding example and very original type of magazine devoted to future oreented thinking...".

2 PARTS OF THE BULLETIN

Each issue of the Bulletin usually has three distinctive parts. These are described in the succeeding sections.

21 "Introduction"

In the "Introduction", written either by the editor of the Bulletin or by an invited scholar, some of the documents abstracted in the issue are briefly commented upon, and the main points of the proposals highlighted. This is a useful feature of the Bulletin, providing a quick but pithy review of the ideas in the documents.

22 "Peace Proposal Abstracts"

The part entitled "Peace Proposal Abstracts" consists of the abstracts of documents. The abstracts are grouped into 5 to 7 broad topics in each issue. For example, the four issues of the first volume of the Bulletin grouped the abstracts under different headings as indicated in the following table.

Issue 1	Issue 2	Issue 3	Issue 4
1 Science and development	1 Human environment	1 Peace research: Aims and objectives	1 United Nations reappraisal
2 Socio-political issues	2 Socio-political issues	2 Programming the future	2 Development policies
3 World peace and disarmament	3 Non-military defence	3 Socio-political issues	3 Education for peace
4 European security and co-operation	4 International co-operation and disarmament	4 The International scene	4 Science and the scientist

Issue 1	Issue 2	Issue 3	Issue 4
5 Vietnam conflict	5 European security and co-operation	5 Problems of disarmament	5 International relation and disarmament
	6 War in the Middle East	6 War in Indo-China	6 African notes
		7 Latin American dilemmas	7 War in the Middle East

About 6 to 10 abstracts are grouped under each topic. For example, the Class "Human environment" in issue 2 contains abstracts of the following 8 articles:

SN	Author	Title
1	U Thant	Problems of human environment
2	Lord Ritchie-Calder	Mortgaging the old homestead
3	Rolf Edberg	The challenge to our generation
4	K Auchin Closs and W Brink	The ravaged environment
5	Richard Nixon	A programme to fight pollution
6	Victor Cohn	Good environment and good politics
7	R E Cook, W Haseltine, and A W Galston	Destruction of the environment
8	Michael Meeropol	Radicals and the problems of ecology

23 "Articles"

The third part consists of original articles comments, and suggestions. An issue contains two or three original articles. For example, Issue 1 contains the following three articles:

SN	Author	Title
1	John Galtung	Seven theses on the European Security Conference.
2	Merck Thee	The protracted Vietnam negotiations
3	Egil Fossum	Some comments on the possible contribution of the military to the peaceful development of the poor countries.

This is another somewhat unique and commendable feature of the Bulletin. An article may discuss a chapter of a recent book or thesis; or it may be an extract from a lecture.

3 SPECIAL FEATURES

31 Scope of "Paace Proposals"

Even though at a first glance each and every "Proposal" abstracted in the Bulletin may not appear to be directly related to "peace", they all have their own share, direct or indirect, in maintaining peace. A broad definition of "Peace proposals" has been accepted by the Bulletin in order to cover different tendencies and a great variety of opinions. As a result the Bulletin has a wide coverage . A rough classifica-

tion of the subjects covered by the abstracts shows that subjects going with the following Main Subjects and Partial Comprehensions are included in the Bulletin:

1	Space Science	10	Education
2	Ocean Science	11	Geography
3	Environment Science	12	History
4	Natural Sciences	13	Political Science
5	Engineering	14	Economics
6	Technology	15	Industrial Economics
7	Biology	16	Sociology
8	Medicine	17	Social Work
9	Public Health		

32 Focus

There are abstracting periodicals devoted to specific subjects, or combination of subjects of varying extension. But, the specific focus of the Bulletin is an Isolate Idea -- Peace -- which may go with a number of different subjects. The Bulletin has succeeded in bringing together all documents, dealing with "peace" in some way or other, from diverse subject fields.

33 Coverage of Documents

The Bulletin covers articles from a variety of publications, such as:

1 Book;
2 Learned periodical;
3 Newspaper;
4 Official publication; and
5 Unofficial publication.

Both printed documents as well as those produced by near-printing processes are covered.

Very few abstracting periodicals abstract articles in newspaper, and official documents. Therefore, this adds to the usefulness of the Bulletin.

34 Selection of Papers

The contributions abstracted in the Bulletin are by scholars, subject specialists, and other persons of eminence. Documents of personal authorship as well as by corporate authorship, national and international are included.

35 Language

The major part of the Bulletin is in the English language. However, there are a few abstracts in French and German. The abstracts for a document for which an English translation is not available, is presented in these two languages.

36 Users of the Bulletin

The subject coverage of the Bulletin shows that its potential users would be specialists belonging to diverse disciplines. It is of use to higher academic institutions, political decision-makers, and any body concerned with international and inter-society affairs. The primary users of the Bulletin, however, are persons involved in Peace Research in one manner or other.

37 Structure of Entry

In Part 2 of the Bulletin the structure of an

entry carrying abstract is of a special kind. The following is illustrative:

Re: Research in cosmos

Author: Sir Bernard Lowell, Professor of Radio Astronomy and Director of the Experimental Station, Jodrel Bank, Nuffield Radio Astronomy Laboratories, University of Manchester, England.

Date: September 1969

Form & Place: Article in Bulletin of the Atomic Scientists

Reference: 'Man moves into the Universe' Bulletin of Atomic Scientists, VXXV, N7, September 1969, P 4-6.

Content: '... Appollo may have a cataclymic effect on terrestrial society ... Now the world ..."

38 Abstract

An abstract given in the Bulletin has some special features, such as the following:

1 It is fully informative.

In fact, it is more than an informative abstract, and amounts to a "mini-article" by itself. Some abstracts extend to three pages, the minimum length being a page;

2 A major part of the abstract is in the words of the author of the original article -- that is, it is an extract; and

3 The editors contribute to the abstract so as

to connect the different extracts. These sentences are printed in italics.

Thus, although the Bulletin is a secondary periodical, in many a case the reader may find the information given in the abstract sufficient for practical purposes.

4 SOME INADEQUACIES

41 Items of Information in an Entry

Each abstract in the Bulletin is introduced by a kind of annotation indicating the source document and by whom, when, where and how the proposal was put forward. For example,

Date: October 7, 1969
Form and place: Articles in The Times
Reference: 'Man's deteriorating environment', The Times, October 7, 1969, P 8.

It would appear that the information contained in the first two headings is, in a way, repeated in the next heading. There is no statement in the Bulletin explaining the particular purpose of this redundancy. At times the repetition of the information given under the headings "Date" and "Form and Place" again under the heading "Reference" may cause confusion. Consider, for example the following entry:

Date: November 10, 1969
Form and Place: Address to the nation by television and radio
Reference: 'Text of President Nixon's address', International Herald Tribune, November 5, 1969, P 2.

The librarian and the reader of the abstract would like to know:

1 What does the date "November 10, 1969" represent?

2 Is it the date of President Nixon's address?

3 If so, was the text of the speech published earlier (November 5) in the newspaper?

42 Standard for Bibliographical Reference

There are national and international standards for bibliographical reference. Such a standard usually prescribes the form of entry for name of author -- personal or corporate --, the title of the document referred to, abbreviations, if used, for the title of the host document, the volume number, issue number, pagination, series etc. The Bulletin should preferably use such a standard so as to secure consistency and economy in making up the entries.

5 GROUPING OF ABSTRACTS

The abstracts are grouped under broad subject headings. As has been indicated in Sec 21, the abstracts in each issue may cover different subjects. At present the number of articles under each major group is few. Therefore, the broad grouping does not raise any problem, In due course, when the number of abstracts in each group increases, it will become necessary to use some principles for arrangement. It would be helpful to start the practice even now. Use of a good scheme for classification -- such as an analytico-synthetic freely faceted classification -- for the purpose will be helpful. It will also help in formulating expressive subject headings.

6 SUBJECT HEADING

61 Inadequacy of Title

Many of the titles are not expressive of the subject embodied in the respective host documents. It is, therefore, essential to use expressive subject heading for each abstract. It will save the time of the reader.

62 Inadequacy of the Present Subject Headings

The Subject Headings used in the Bulletin at present are not fully expressive of the subject content. For example, the subject heading given for the article entitled "The state of the Union now and in decade ahead" is "Battle against pollution". A perusal of the article reveals that the specific subject dealt with in it is "Control of Pollution in USA".

63 Subject Heading and Indicative Abstract

To secure consistency and maximum efficiency, it is helpful to derive the subject headings from the facet analysis for each subject. The use of a scheme for classification suggested in Sec 5 would serve this purpose also. Further, such an expressive subject heading will obviate the need for an indicative abstract. At present there appears to be a need for such an indicative abstract in the Bulletin, because between the 2-page fully informative abstract and the none too systematically formulated subject heading there appears to be a gap wide enough to be filled in by an indicative abstract. The "Introduction" in each issue partly fulfils this purpose.

7 INDEX

A good index to subjects and authors covered by the abstracts has been published with issue 4 of volume 1. Such a timely production of the index is commendable.

8 ACKNOWLEDGMENT

I am thankful to the Editors of the Bulletin of peace proposals for making available to me for this study the first four issues of the periodical. I am also thankful to Prof A Neelameghan for suggesting the subject and for guidance in writing the paper.

C O N T E N T S

AREA 2 : PATTERN OF USE OF DOCUMENTS BY SPECIALISTS

Paper	Author and Title	Page
BA	NEELAMEGHAN (A). Use of information in research, invention, and innovation: Case studies.	115-38
BB	ROSEN (Stephanie) and FENNIG (Sharon). Use of the publications of international organisations in the Graduate School of International Studies, University of Denver.	139-63
BC	RAGHAVENDRA RAO (G S). Pattern of use and search for documents by specialists: A case study through citation analysis, questionnaire, and interview.	164-89
BD	NAGARATHNA (R A). Use of documents by nuclear physicists and metallurgists: A case study.	190-204
BE	GUNDU RAO (D). Citation of documents in radio engineering: A case study.	205-16
BF	KARTHIKEYAN (S). Citation of documents by specialists: A case study.	217-31
BG	JOHNSON (E). Use of information by biologists : A case study. ..	232-7
BH	RAGHAVENDRA RAO (G S). Kinds of impact of information on postgraduate research: Case studies. ..	238-64
BJ	RAVICHANDRA RAO (I K). Obsolescence and utility factors of periodical publications: A case study. ..	265-82

DRTC Seminar (9)(1971). Paper BA.

USE OF INFORMATION IN RESEARCH, INVENTION, AND INNOVATION: CASE STUDIES.

A NEELAMEGHAN, Documentation Research and Training Centre, Bangalore 3.

[Dissemination and diffusion of knowledge take place through several channels. The nature and result of impact of information on research and on the generation of new ideas are of various kinds. Several sociological, institutional, and human factors affect the dissemination, diffusion, and use of information in an organisation. Thirty case studies, from published reports, are presented, to illustrate the use of information by research workers, inventors, and innovators].

1 GENERATION AND DIFFUSION OF INFORMATION

Knowledge is generated at many points the world over -- research institutions, universities and other academic institutions, and industrial and commercial organisations. From the point of generation, the knowledge diffuses, within the organisation and outside it, through a variety of channels. A piece of knowledge thus

communicated gets used, tested, and applied. It may generate new knowledge. Thus, the wavefront of knowledge keeps advancing in different directions. Effective utilisation of the available knowledge in a manner that would lead to new inventions, discoveries, and innovations depends on several factors.

2 INFORMATION INPUT IN RESEARCH AND DEVELOPMENT

21 Librarian's Concern

It is being increasingly realised that information is a basic input to each facet of research and development. Conditions must be created such that the information flows to the points where it is likely to be most effectively used. Appropriate channels must be established for this purpose. A channel should not get clogged with unwanted information. Information should be made available to the research worker, or engineer, or production technologist just when it is needed. It should be presented in a form most conveniently usable in relation to the purpose, context, and user. All of these is the concern of library service.

22 Scientific and Technological Information

Studies on the generation and diffusion of knowledge has raised some useful points (12-14, 16):

1 New information becomes known to a scientist's peers in the world scientific community much earlier than to other groups, well in advance of any formal written publication.

2 In technology, including application of science and engineering, creative efforts are primarily concerned

with the integration of previously existing knowledge to produce usable commodities and services including, for example, systems, devices, processes, methods, and materials.

3 Pure research and phenomenon-oriented research is concerned mainly with the generation of knowledge about some phenomenon or other.

4 The knowledge generated from pure research and phenomenon-oriented research is made available to the scientists and technologists in several ways and through several channels.

5 Technological events are usually initiated within technology, in the presence of an ambient science. With a few exceptions, it is usually difficult to establish a unique correlation between an important technological advance with a piece of knowledge generated by pure research or phenomenon-oriented research.

6 In general, technology feeds upon knowledge generated in the technological field, while pure research and phenomenon-oriented research feeds upon knowledge generated in the field of pure research and phenomenon-oriented research. However, there are several inter-connections across the two spheres of activity.

3 SOURCES AND CHANNELS

31 Usual Sources

The sources and channels of information that may result in a major invention or an improvement in an existing technology are many and varied. These include:

1 Document (External)
Book, periodical, technical report, patent, standard, specification, thesis, trade publications, government publications, review and trend report, preprint/reprint exchange, card service, indexing and abstracting services, etc.

2 Information dissemination centre
Documentation centres, information analysis centres, clipping services, associations, etc.

3 Vendor/Supplier/Contractor
Representative of or document generated by, vendor/supplier/contractor.

4 Customer
Representative of or document generated by, the agency for which a project is carried out.

5 Consultant/Adviser/Guide

6 Meeting

7 Mass media

8 Formal course

9 Through colleagues

10 Institutional source
Other institutional research projects; colleagues in the institution; documents generated within the institution.

11 Personal experience in similar, related, or other work.

32 An Example

William J Price mentions the pattern of link bet-

ween the scientific community and the research activity of the US Air Force Office of Scientific Research (= AFOSR). It is a two-directional communication -- information for finding solution to the scientific problems of the Air Force and the availability of information to the users. The link or coupling is established in the following ways (15):

1 Part of what the AFOSR purchases through contracts and grants is primarily designed to provide communication. The symposia and related sponsored research helps the AFOSR to keep abreast of the developments in science and technology; and

2 Direct involvement and participation of scientists through AFOSR contracts. For instance,

21 Trips to Air Force installations to provide consultancy service;

22 Membership on ad-hoc groups to study the feasibility of various exploratory-development programmes;

23 State-of-art review, either oral or written;

24 Special purpose symposia specifically designed to bring technologists and scientists together;

25 Special lecture tours;

26 Feasibility studies on research phenomenon to package them in a form more likely to be useful; and

27 Direct consultation with aerospace industries.

4 RECENT INTEREST ON DIFFUSION OF TECHNOLOGICAL INFORMATION

The differential utilisation and performance of the different sources and channels of information in research and developmental activity have been investigated (1). The process of diffusion of technological information and the several sociological, institutional, and human factors affecting it within an organisation and in the scientific and technological community in general, have also been examined (2,7,19). The MIT Conference on the Human Factor in the Transfer of Technology (6), University of Nottingham Symposium on Accelerating Innovation(3), and the report of Gilmore and associates (5), are other examples of such studies. Wood has reviewed "user studies" of recent years (20) and the Drexel list (4) has abstracts of over four hundred of such studies upto to about 1964.

5 IMPACT OF INFORMATION

51 Wastage and Pay-Off

In an earlier paper, several case studies were presented showing, in quantitative terms, the wastage resulting from duplication of research and development work due to the non-availability in time of information on work already done and of the pay-off from timely information (11,18).

52 Modification of Work in Progress

521 Aslib Survey

The impact of information on a piece of research in

progress and on the report on the project may be of various kinds (9). In a survey of such impact of information on research, carried out by the Aslib (10) the responses from 245 scientists were analysed as follows:

	N of responses
1 Information made available indicated duplication of work of others. ..	43
2 Information, had it been previously known, would have led to:	
1 Plan research differently	36
2 Alter the plan of research in progress	60
3 Saving of time, money, and research potential	106
	245

Allen has carried out studies on the impact of different sources of information on decisions in research and development (2).

522 Modification of Research Effort After Attending Conference

Lin and others, in a survey of the impact of information exchange at meetings, have reported as follows (9).

SN	Nature of Modification	% of 473
1	Broadening of scope of effort, introduction of wider range of variables or effects	29.1
2	Redirection, revision, re-evaluation of effort	22.4
3	Theoretical, conceptual, or orientational change	19.0
4	Introduction of new methodology, instrumentation, or materials	18.5
5	Reinforcement or stimulation of current effort	14.2
6	Increase in background knowledge, state-of-art information, trend, etc ..	10.1
7	Incorporation in own effort or cite data or results	9.4
8	Application of information in design or development work	8.9
		131.6*

*Some authors reported that they modified an activity in more than one way. Therefore, the percentages add to more than 100.

523 Modification of Research Report

Lin and others have also presented the following survey data on the nature of modification resulting from feedback from prepublication reports (9).

SN	Nature of Modification	% of 1,220
1	Stylistic changes	43.0
2	Clarification or redifinition of concepts, new or further exploration of theory, etc	34.3
3	Changes in general form or organisation of presentation	28.2
4	Incorporation of others' findings or citing new work, etc	22.6
5	Clarification of methods or procedures	19.8
6	More detailed description of results or of a process	19.4
7	New emphasis or change in interpretation of findings	17.3
8	Collection of additional data, remeasurement of variables, etc	11.2
9	Replication of some aspects of research, reanalysis of data, etc ..	9.6

53 Changes in Doctoral Program

Raghavendra Rao reports, from a survey of thirty-two doctoral candidates in a research-cum-teaching institution, several cases of change, modification, or stimulation of research on the basis of information gathered from published documents (See DRTC Seminar (9)(1971), Paper BH).

6 CASE STUDIES

61 Published Reports

Jewkes, Sawyers, and Stillerman in their report of fifty-six case histories of outstanding invention and innovation in the field of engineering and technology, some of which have developed into large industries, men-

tion several instances of the impact of information on the formulation of the idea constituting the invention or innovation (8). Similarly, Price and others report the experience of the AFOSR on the diffusion of scientific and technical information in more recent years (17). Extracts from some of the case histories are given in Sec 62 as illustrative examples.

62 Extracts from Reports

Case 1: SOLID STATE MASER

In 1955, in their investigations on electron spin resonance in solids, Dr Tiffani and Dr Kikuchi at the University of Michigan, examined various crystals including ruby. Incidentally they observed that the ruby had properties which would make it useful in microwave amplification. The results were made available to others who developed the ruby as the basis for the first practical solid state maser (17).

Case 2: CYCLOTRON

While reading a paper by R Wideroe, a German physicist in the spring of 1929, Dr E O Lawrence at the University of California, found the clue which led to the invention of the Cyclotron (8).

Case 3: POWER STEERING

In the early 1920s, Francis W Davis, Chief Engineer of the truck department of the Pierce-Arrow Motor Car Company, became aware of the difficulty of steering heavy vehicles. He made a survey of the documents on servomechanisms and concluded that a hydraulic system would be

more suitable. The difficulty of producing a silent, cheap pump was overcome with the advice of a professor at MIT (8).

Case 4: AIRCRAFT PERFORMANCE

The theory of three-dimensional interference effects developed by Dr Antonio Ferri, Polytechnic Institute of Brooklyn, was used by the Grumman Aircraft Company to design the air inlet for the FIIF-IF aircraft. It resulted in a considerable increase in the power available from the jet engines. During this development, Dr Ferri was a consultant to Grumman (17).

Case 5: FLUORESCENT LIGHTING

Late in 1934, the American General Electric Company was informed by their consultant Dr Arthur H Compton, of the Ruropean progress with cold-cathode fluorescent lights. The Company developed a model for general use. Dr George Inman, in charge of GEC's development programme, received a patent on the appropriate combination of elements in a practical lamp (8).

Case 6: AIR CUSHION VEHICLE

Christopher Cockerell, a British electronics engineer, had been thinking in 1957 about flexible structures for hovercraft, to let the machine conform to the rough surface of water. In 1958, he applied for a patent covering this idea. A British consulting engineer, C H Latimer-Needham had patented the principle a little earlier, but his ideas were not known to the hovercraft engineers at that time. After reading a description of the Curtiss-

Wright air car, R Stanton-Jones, then chief designer of Saunders-Roe, tested flexible skirts (8).

Case 7: HELICOPTER

In the 1930s, Dr Henrich Focke designed the first practicable helicopter, with two counter-rotating rotors arranged side by side on outriggers. After an intensive study of previous work on helicopter, he proceeded systematically from first calculation to wind tunnel and full scale experiments, flew a successful model in 1934, a full-scale machine in June 1936, which in 1937 reached a height of 8,000 feet and a speed of 76 mph and proved both stable and comfortable (8).

Case 8: CORRECTION OF ORBIT

Prof S Herrick of UCLA developed theories of differential correction of orbits. His theory was used by Aeronutronic Division of Philco, to design orbit of the Mercury capsule. Prof Herrick was at that time consultant to Aeronutronic (17).

Case 9: REENTRY SPACE VEHICLE

One of the design problems of reentry space vehicle is to assume that they are unstable in all but the nose-first altitude. One of the early models was designed to be unstable in all but the nose-first attitude in an atmosphere of normal density. It was found to be stable in tail-first attitude in rarified gases. Information generated by research done by AFOSR and the Office of Naval Research (USA) on rarified gas dynamics at the University of California and other places was used by the

Company for re-designing the vehicle (17).

Case 10: ROCKET

The early pioneers in rocket development were inspired by the classic book Rocket into interplanetary space by Hermann Oberth, published in 1923. Upto 1929, rocket research in Germany was carried out by individuals and the small group in the VfR -- Society for Space Travels, the most active members of which were Klaus Riedel, von Braun, Ley and Nabel. After six years of experimentation which saw many failures, the "Repulsor" rocket reached altitudes of over half a mile. The results of the Society's experiments were freely published. The Society disintegrated when the Nazi Government came to power. However, the work of the Society encouraged several enthusiasts to continue the experiments, and a number of them, in particular von Braun, were later key members in the Peenamuende rocket station (8).

Case 11: RESTARTABLE SOLID PROPELLANT ROCKET

Under the direction of Dr N W Ryan and Dr A D Baer, University of Utah, the relation between ignition temperature and initial temperature of a solid propellant rocket had been studied. Using the published results, an industrial group successfully applied the ideas achieving a significant reduction in the number of low-temperature test firings required during the development of a restartable engine (17).

Case 12: COMBUSTION INSTABILITY IN ROCKET ENGINE

Prof P D McCormack, University of Dublin, presented the results of his research on the effects of vibration

on the stability of combustion in engines, at an AFOSR-sponsored symposium attended by specialists in combustion dynamics. Personnel from Rocketdyne, who were concerned with the design of a medium-sized rocket engine for NASA, made use of Prof McCarmack's work to eliminate combustion instability encountered during tests of the NASA engines (17).

Case 13: CAVITY MAGNETRON

In the autumn of 1939, the British Admiralty asked Prof M L Oliphant and the Physics Department of the University of Birmingham to develop a high-power micro-wave transmitter. Most of the scientists in the Laboratory concentrated on the Klystron described by RH and SF Varian of Standard University, California, in 1939, for the production of high frequency power. J T Randall and H A H Boot, realising the difficulty of getting enough power from the klystron, applied the resonator principle to the magnetron described by A W Hull of the American General Electric Company in 1921. The original magnetron did not possess the features they were seeking. The work resulted in the Cavity Magnetron, which proved to be the needed generator producing high power for microwave transmission (8).

Case 14: ELECTRONIC DIGITAL COMPUTER

The theoretical studies of computable numbers and functions published by mathematical logicians during the 1930's helped the design of practical computers possible (8).

Case 15: PHOTOELECTRIC DEVICE FOR TITRATION

Information on Dr H V Malmstadt's work at the University of Illinois, using a photoelectric device for determining the end point in titrations, such as in blood-glucose measurement, led to the wide use of the device and procedure (8).

Case 16: OXYGEN STEEL MAKING

The present commercial oxygen top blowing process arose out of the experiments carried out by Dr Robert Durrer, from about 1929, when he was a Professor in Germany. His ideas were tested in the late forties. Dr Theodor E Seuess and his staff at the Austrian Steel making firm VOEST, learnt of Durrer's findings and perfected the necessary operating conditions in oxygen steel making (8).

Case 17: TITANIUM PRODUCTION

W J Kroll, working in his private laboratory in the 1920s, made substantial contributions to modern metallurgy. When he published his work on an improved process for beryllium electrolysis, Siemens and Halske became interested and the parties exchanged information. Kroll acquired a knowledge of vaccuum technique, which proved a help later in his work on titanium production. The US Government, Bureau of Mines Experimental Station in Arizona, came to know of Krolls' process for titanium production through his article published late in 1940 in the Journal of the Electrochemical Society (8).

Case 18: SEMI-SYNTHETIC PENCILLINS

The Beecham Research Laboratory (UK), on the suggestion of its Chief Scientific Consultant, Sir Charles Dodds, sought the advice of Prof E B Chain in 1954 on possible ways of entering the antibiotic field. Prof Chain, then Director of the International Research Centre for Chemical Microbiology in Rome, was a member of the Oxford Team concerned with discovery and development of pencillin. He strongly recommended the Company not to try to discover new antibiotics through screening techniques but to intensify the work on the modification of the pencillin molecule, particularly with the aim of obtaining pencillins resistant to the action of pencillinase. The Beecham Group accepted his advice and in 1957 the existence was predicted, and then established, of the pencillin nucleus itself. New semi-synthetic pencillins with desirable properties have come out of the work (8).

Case 19: NEOPRENE

In 1925, Dr E K Bolton suggested to his company du Pont, that they should investigate methods of synthesising rubber from acetylene. Little progress had been made when he heard Father Nieuland lecture on divinylacetylene at the American Chemical Society. Dr Bolton discussed with Father Nieuland about du Pont's interest and the possibility of using divinylacetylene as a starting material. Du Pont's chemists visited Nieuland to gain first-hand knowledge.

Du Pont's chemists then investigated divinylacetylene with an entirely different purpose in mind. Arnold M Collins set out to identify the impurities in divinyl-

acetylene, and showed two of them to be monovinylacetylene and a compound containing chlorine. Wallace H Carothers, discoverer of Nylon, suggested conduct of reaction between hydrogen chloride and monovinylacetylene. This led to a new product Chloroprene which polymerises spontaneously to give Neoprene (8).

Case 20: BAKELITE

Baekeland's invention is a hard, infusible, chemically resistant plastic (bakelite) and the process for producing it. He perused all earlier patents particularly on plastics which indicated that such a plastic could be obtained only if the temperatures were kept below 100°C. Ignoring the traditional approach, Baekland demonstrated that much higher temperatures are required to create a plastic of exceptional quality (8).

Case 21: NYLON AND PERLON

I G Farbenindustrie in Germany intensified studies on linear condensation polymers when the basic patents on the work on Nylon fibre by W H Carothers of du Pont (USA) were published. In 1938, the German company took out patents on results obtained from the work of their research team directed by P Schlak. The process for making Perlon fibre did not conflict with the Du Pont patents (8).

Case 22: POLYETHYLENE

In the 1920's, the Alkali Division of the Imperial Chemical Industry (UK) sent its employees R D Wilson and M W Perrin to work with Prof A Michels in Amsterdam. Prof Michels had developed techniques for measuring the

effects of pressure on the physical properties of matter. Encouraged by the report of the discovery of P W Bridgman and J B Conant at Hervard that high pressures markedly affected polymerisation reactions, ICI started in 1932, a study of the effects of high pressures on chemical reactions, as suggested by Perrin and J C Swallow. Polyethylene resulted from the study (8).

Case 23: TERYLENE

Terylene was discovered in March 1941 by J R Whinfield and J T Dickson, research workers at the Calico Printers Association. The crucial idea came to them from a study of the work of W H Carothers on condensation polymers (8).

Case 24: SILICONE

The fifty-one papers of Prof F S Kipping of Nottingham University, published between 1899 and 1941, are the best sources of knowledge of organo-silicon chemistry. The commercial development of silicones was made possible on the basis of the studies of the fundamental mechanisms of polymerisation and the properties of macro-molecules by Prof H Staudinger, Emil Fischer, W H Carothers and others between 1914 and 1930s (8).

Case 25: SYNTHETIC DETERGENT

Reports of academic research by German, Belgian, and British chemists have shown that various classes of compounds having certain common structural features, had useful detergent qualities. Then industry selected the compounds which could be produced on a commercial scale. (8).

Case 26: TETRAETHYL LEAD ANTI-KNOCK

From about 1912, Charles Kettering, then of the Dayton Engineering Laboratories Company, along with Thomas Midley, a graduate mechanical engineer, from Cornell, set out in search of a cure for 'Knock'. They tried various chemicals. After World War I, Kettering published his results uptodate and consulted large oil and chemical firms with a view to interest them in the production. In 1919, Kettering and Midley joined General Motors. Kettering chanced to read of the work of Prof Victor Lenher of Wisconsin, on selenium oxychloride. This was a compound which they had not tried for antiknock property. Contrary to expection, it greatly reduced knock when it was tried. It was concluded that the rare metal selenium was responsible for the result. Selenium and tellurium gave disagreeable smell and penetrated the skin. So Midgley looked for more suitable metals. Dr Robert E Wilson of MIT showed Midgley a chart of a periodic system he had drawn up in which the elements are arranged according to their electropositive and electronegative properties. Starting with tetraethyl tin, Midgley was led to tetraethyl lead (8).

Case 27: CHLORDANE

Julius Hyman was intimately involved in the discovery of the insecticides chlordane, aldrin, and dieldrin. Early in 1944, the Rubber Reserve of the US Government asked Hyman, then Vice-President of Velsicol Corporation, if he could make use of its cyclopentadiene produced apparently as a useless product. In July 1944, Hyman read about an unusual reaction, discovered by Fritz Strauss and

his students in Germany in 1930, for the production of hexahalocyclopentadiene (hex) from cyclopentadiene. On Hyman's instruction, S H Herzfeld produced a sample of 'hex'. The white residue (237) left on distilling hex was found to have insecticidal property, though less than that of DDT. Hyman guessed the correct structure of 237 as a Diels-Alder adduct of cyclopentadiene and hex. At Hyman's suggestion, '237' was chlorinated, and the resulting 'chlordane' proved to be more toxic than DDT. Velsicol developed the commercial process for the insecticide (8).

Case 28: SHELL MOULDING

Shell moulding is a revolutionary casting process invented in 1941 by Johannes Croning, the proprietor of a Hamburg foundry. He developed the process by combining a modification of existing foundry practice with a process familiar in another industry -- the use of liquid synthetic resin as the binding agent practised in the refractory industry. Croning's work was discovered when the Allied Technical Teams were searching in Germany for developments made during the war. The US Department of Commerce reported the findings in a FIAT report in 1947 (8).

Case 29: PREVENTION OF RHESUS HAEMOLYTIC DISEASE

In 1957, doctors Shepard, Clarke, McConnell, and R Finn at Liverpool, carried out a large family study on the interaction between the rhesus and ABO blood systems. The results were published in an article in 1958. These and further studies confirmed that ABO incompatibility reduces the risk of Rh haemolytic disease by about one-fifth. Early one morning, Mrs Clarke woke up her husband

to suggest he might use the antibody formed against the Rhesus factor to prevent the occurrence of rhesus haemolytic disease. The idea was discussed in the Department and at a Liverpool symposium in 1960. Dr Finn tentatively put forward the view that it might be possible to destroy foetal blood cells in the maternal circulation following delivery by means of suitable antibody, thus mimicking the natural protection afforded by ABO incompatibility. During the next four years, the Liverpool group carried out experiments. The results of the first experiments were published in the British medical journal in May 1961.

Meanwhile, in 1959 Dr J G Gorman of the Blood Bank at Columbia Presbyterian Hospital, New York, Dr V J Freda, an obstetrician, and Dr W Pollack, an British immunologist of the Ortho Research Foundation in USA, made a direct approach to the study of the Rh haemolytic disease. Dr Gorman first learnt of the principle of passive antibody mediate immuno-suppression from a copy of Florey's Textbook of pathology, presented to him by the publisher. The team had mapped out a project similar to that of the Liverpool workers, though based on a different line of reasoning, when the BMJ article, together with an editorial on the subject, appeared in May 1971. Their first reaction was one of dismay at being scooped for publication. However, it had the effect of boosting up their own project.

"An unusually interesting case of individual initiative was revealed in 1967 when Dr Eugene Hamilton of St Louis stood up at one of Dr Gorman's lectures and announced that he had started clinical trials in April 1962 after reading the BMJ article of May 1961"(8).

Case 30: XEROGRAPHY

In 1934, Chester Carlson employed as patent attorney for the P R Mallory Y Company was struck by the laborious methods of producing copies of documents then in use. He steered clear of the silver halide process and other chemical processes fully exploited by Eastman Kodak and others. He thought of processes depending on the effect of light and was led to investigate the photoelectric phenomenon. Carlson spent a good deal of his spare time, for three or four years in the New York Public Library, reading technical documents and patents. The use of electrolytic effect occurred to him, but he abandoned it and looked for a process involving high voltage and low currents. He wrote "With the problem so sharply defined, the solution came almost as an intuitive flash. I was aware that a previous inventor had used powder to develop electrostatic images. By combining that with my concept of an electrostatic light-sensitive plate, the invention was complete and it only remained to search the literature to see whether a suitable photoconductive material was known."

In 1946, the Haloid Corporation of New York learnt about xerography from an article on the subject written in 1944. After investigating the process, they accepted an exclusive sub-licence under the patents (8).

7 CONCLUSION

The case histories of notable inventions, discoveries, and innovations presented in the preceding section illustrate (1) the important role of information in triggering new ideas; and (2) The different ways in which the required information may reach the inventor or

innovator. The importance of person-to-person dissemination of know-how is noteworthy. Gilmore's survey of industrial organisations indicates that the "personal channel" -- supplier personnel, customer personnel, consultancy, and meetings -- has top ranking as external channel of information for problem solving (5). Some of the inventors when they first applied for a patent found that they had been preceded by other inventors in that line. Examples are: Wankel rotary piston engine (F Wankel, 1954); stainless steel production (Elwood Haynes, 1912); continuous hot strip rolling (Columbia Steel Company and American Rolling Mill Company, 1927); Float glass (A Pilkington, 1954-59); Ball-point pen (Milton Reynolds, 1945). On the other hand, the Rust brothers, innovators of the cotton picker, and Dr Frederick Banting, who developed a method of extracting insulin, felt that they would, perhaps, have never gone foreward with their ideas if they had read the earlier reports of the difficulties and failures in their respective lines of work.

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138

DRTC Seminar (9)(1971). Paper BB.

USE OF THE PUBLICATIONS OF INTERNATIONAL ORGANISATIONS IN THE GRADUATE SCHOOL OF INTERNATIONAL STUDIES, UNIVERSITY OF DENVER.

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[The objective of this study was to determine the state of knowledge of publications of international organisations among the readers in the Graduate School of International Studies. The study was undertaken as an initial step in the preparation of a library handbook for the use of these publications. The method selected was to design a questionnaire covering the use of the publications, as well as the reader's knowledge of access to them and the library policy in their handling -- such as, cataloguing, location, and circulation. Due to the relatively small number of people involved, the entire faculty and student body in residence during the winter quarter was surveyed. It became evident that the population had limited knowledge of the publications being considered. Therefore, a tool -- such as, a handbook -- is proposed to give a general introduction to the body of documents and their treatment within the university library system. It would also include information on specific organisations whose publications have more frequent use and pose particular problems.]

Abbreviations Used:

BA	Business Administration Library
CENTO ..	Central Treaty Organisation
Council.	Council of Europe
DU	University of Denver
FAO	Food and Agricultural Organisation of the UN
GATT ...	General Agreement on Tariffs and Trade
GSIS ...	Graduate School of International Studies
Hague ..	Hague, International Court of Justice
IAEA ...	International Atomic Energy Agency
IBRD ...	International Bank for Reconstruction and Development
ICAO ...	International Civil Aviation Organisation
ICJ.....	Hague, International Court of Justice
ILO	International Labour Organisation
IMCO ...	Intergovernmental Maritime Consultative Org
IMF	International Monetary Fund
IO	International Organisations
IR	International Studies Library
ITU	International Telecommunication Union
League .	League of Nations
LC	Library of Congress
MRL	Mary Reed Library
NATO ...	North Atlantic Treaty Organisation
OAS	Organisation of American States
OAU	Organisation of African Unity
OECD ..	Organisation for Economic Cooperation and Development
UN	United Nations
UNCTAD .	United Nations Conference on Trade and Development
UNESCO .	United Nations Educational, Scientific and Cultural Organisation
WHO	World Health Organisation
WMO	World Meteorolcgical Organisation.

1 INTRODUCTION

11 Sensing of a Problem

Library records and staff experience indicate that there is a problem in the use of publications of international organisations. The reader is ignorant about the existence of such publications, because the cataloguing and explanation of the use of these publications are inadequate in many cases. Yet, these documents are

potentially valuable in that they concern international negotiations and international cooperation in a wide range of fields. A handbook explaining how to find these documents would save time and trouble for the staff and readers. Hence, this study was undertaken as an initial step in the preparation of such a tool.

12 Conspectus

The method employed was a standard survey. It is discussed briefly in Sec 2. A copy of the questionnaire is included in the appendices. Sec 3 and 4 mention the question and the results obtained. The interpretation and evaluation of the results are presented in Sec 5 and 6. The purpose here has been to correlate the data with the objectives.

The concluding Sec 7 summarizes the results and presents recommendations for the production of a handbook for the use of publications of international organisations within the present University of Denver library system.

2 PROCEDURE

21 General

The method selected was a fairly uncomplicated and a straightforward one. The population consisted of the faculty and students of the Graduate School of International Studies who are currently in residence. The entire population was surveyed.

The questionnaires were circulated to faculty mail boxes and student study carrels, and were returned to the office of the Graduate School of International Studies.

The responses were tabulated in a composite form and also in three divisions: faculty, first-year students, and second-year or more advanced students. The scores were converted to percentages for the purpose of comparison.

22 Experiment

221 After identifying the problem regarding the knowledge of publications of international organisations, a bibliography of such publications was prepared.* This bibliography was used to derive information on two factors:

1 The international organisations for which the University of Denver libraries have a significant selection of materials; and

2 The types of documents which the various organisations publish and how they are handled in the library system.

222 In order to determine the knowledge of existence of the publications and the knowledge of how to use the documents on the part of the readers, a questionnaire was prepared*. The questions primarily cover the United Nations, the League of Nations, and the Organisation of American States, because their publications require special treatment. The publications of the other organisations are classified according to the Library of Congress system.

223 Each reader was asked to identify himself as either first year-student, second year student, or faculty, because the difference of educational background could be significant. The question concerning special areas of study was included for the same reason.

224 Seventy-four questionnaires were sent: sixteen to faculty members and fifty-eight to students. The division between first and second-year students was not known at the time the questionnaires were sent. Eight responses were received from faculty representing a 50 per cent return. Thirty responses were received from students representing a 52 per cent return.

225 It was initially assumed that the population would be interested in returning the questionnaire because

* A copy can be had by writing to the authors

the subject is so closely related to their studies. The percentage of returns, however, is rather low, and the reason for this is suspected to be unusually heavy pressure on the population during the winter quarter. The reasons for such pressure and its very existence could not be determined or measured. Miss Collobert, the Librarian of GSIS, commented that the students seemed to be under unusual pressure. She gave no reasons for this judgment.

3/4 QUESTIONS AND RESULTS

3 ACADEMIC STATUS AND SUBJECT INTEREST

The results of related questions have been compiled whenever it was valid to do so. Therefore, each paragraph does not correspond to a question in the questionnaire. However, the enumeration of the items in the results and analysis sections follow a sequence parallel to that of the items in the questionnaire.

31 Academic Status

Each person was asked to identify academic status. The results were: Faculty, 8; First-year students, 10; and Second-year students and beyond, 20.

32 Specialisation

Each person was asked to list three subjects of interest of specialisation. One person listed four subjects, and not all listed three. Out of the 103 responses, 46 subjects of specialisation were mentioned. There was no uniformity of response, but basically the most frequently mentioned subjects were as follows:

Comparative Politics 9	Central and Eastern Europe and the Soviet Union 6
International Economics 8	Africa 7
International Politics 8	Asia 4
Middle East 5	Latin America 5
Europe, Western Europe 12	

US, US Diplomatic History and Foreign Relations 6
Other 33

32 Organisations of Interest

321 Selected List

From a selected list of international organisations, each reader was asked to identify those organisations whose publications he might wish to consult. The results were as follows:

Organisation	Student		Faculty	
	N	%	N	%
GATT	9	30	0	0
COUNCIL ..	14	46.6	2	25
FAO	11	36.6	4	50
HAGUE	9	30	1	12.5
IMCO	1	3.3	1	12.5
IAEA	3	10	2	25
IBRD	17	56.6	4	50
ICAO	1	3.3	0	0
ILO	10	33.3	3	37.5
IMF	15	50	2	25
ITU	2	6.6	0	0
LEAGUE	14	46.6	1	12.5
OAS	10	33.3	3	37.5
OECD	18	60	6	75
UN	25	83.3	7	87.5
UNESCO	21	70	7	87.5
WHO	7	23.3	4	50
WMO	1	3.3	1	12.5

322 Other Organisations

Each reader was asked to identify other international organisations whose publications he might have need to consult. The results were as follows:

Number of Responses	Organisation
1	Andean Nations Trade Association
1	Arab League
1	Bank for International Settlements
1	CENTO
2	Comecon
1	Cominform
1	Comintern
5	European Economic Community
1	European Free Trade Association
1	Economic Commission for Africa
1	European Launcher Development Organisation
1	European Space Research Organisation
1	International Council of Scientific Unions
1	Inter-American Development Bank
1	International Office of Education (Geneva)
1	International Union of Local Authorities (Hague)
1	Joint Institute of Nuclear Research
2	Latin American Free Trade Association
4	NATO
2	Nordic Council
1	Organisation of Petroleum Exporting Countries
2	Organisation of African Unity
1	Pugwash Conference Proceedings
1	SIECA (Central American Common Market Secretariat)
1	UNCTAD
3	Warsaw Pact
1	World Bank

145

4 LIBRARY-RELATED QUESTIONS

41 Location in DU Library System

Each reader was asked to record the locations of the publications of the organisations in the DU library system. The results are given in the table below. "Correct" responses to this question are listed by percentage. One hundred per cent would indicate that all the readers who identified each organisation in the third question correctly identified its location in this question.

Per cent	Organi-zation	Per cent	Organi-zation
8	GATT	3	ITU
21	Council	29	League
18	FAO	26	OAS
11	ICJ	37	OECD
0	IMCO	69	UN
3	IAEA	47	UNESCO
26	IBRD	5	WHO
0	ICAO	0	WMO
21	ILO		
29	IMF		

42 Classification and Cataloguing

Each reader was asked to identify documents of international organisations which are not classified by the Library of Congress or Dewey systems. Result:

3 per cent knew that League documents were not classified.

5 per cent knew that OAS documents were not classified.

13 per cent knew that UN documents were not classified.

8 per cent thought that Unesco documents were not classified

5 per cent thought that WHO documents were not.

43 UN Documents

431 The location of UN documents was requested. One person did not answer; 84 per cent knew that UN documents were in the IR Library; 13 per cent thought that the UN documents were located elsewhere.

432 The location of an index to UN documents was requested. Four readers did not answer; 63.3 per cent knew that the indexes were in the IR Library; 26 per cent did not know.

433 Knowledge of a shelf list for UN publications was investigated. The results were as follows:

10 readers did not answer;

24 per cent knew that the shelf list is in the IR library;

13 per cent did not know;

39 per cent did not know what a shelf list was.

434 Each reader was asked to give the meaning of the notations used in the UN shelf list. The result was as follows:

Notation	Percentage knowing
separate (or loose) ..	16
sess, no, yr, vol. ..	3
1 - 361	0
I A 1948.3 see E/ECE/1	11

44 League Documents

441 The location of the League publications was requested. Result:

One reader said "Geneva", which is not incorrect;

50 per cent knew that the documents were in the IR library;

19 readers did not answer.

442 A question was asked about the League shelf list. Result:

Twenty-seven readers did not answer this question;
11 per cent knew the location;
21 per cent did not know.

443 Each reader was asked to say what he knew about an index to the League publications. Since such an index does not exist in the DU Library system, it is not surprising that only 16 per cent said they thought one existed. Those who did not respond constituted 82 per cent of the respondents.

45 Frequency of Use

Each reader was asked to indicate the frequency of use of publications of various organisations. The following table gives the results for each organisation in terms of the percentage of the population who had used the documents.

Organisation	Percentage		
	Total	Faculty	Student
GATT ..	16	0	17
Council ..	24	12.5	23
FAO ..	21	12.5	23
Hague ..	5	0	6
IMCO ..	5	0	6
IAEA ..	8	0	10
IBRD ..	29	12.5	33
ICAO ..	5	0	6
ILO ..	16	12.5	13

Organisation	Percentage		
	Total	Faculty	Student
IMF ..	24	12.5	20
ITU ..	5	0	6
League ..	16	0	17
OAS ..	21	25	20
OECD ..	34	0	33
UN ..	61	25	66
UNESCO ..	26	12.5	33
WHO ..	18	12.5	20
WMO ..	3	0	3

46 OAS Publications

461 Each reader was asked to indicate the format of documents of the OAS in the DU Library system. Result:

58 per cent did not respond to this question.

87.5 per cent knew the format of part of the relevant collection.

462 Each reader was asked to indicate his knowledge of the OAS index to its publications. Result:

63 per cent did not answer;

21 per cent did not know;

16 per cent knew an index existed;

11 per cent knew the location;

3 per cent knew the location and format.

47 Type of Document

Each reader was asked to indicate the types of documents which could be found in UN publications,

149

League publications, and OAS publications. The underlined figures in the following table indicate that readers believed that nonexistent document existed!

UN	League	OAS	Type of Document
66%	52%	37%	official records
52	42	34	official documents
76	26	29	statistical documents on demography
69	29	23	statistical documents in international trade
34	21	8	bibliographies
63	29	32	economic statistics by country
61	16	23	economic statistics by larger geographical area than country
76	42	11	yearbook
50	26	26	periodical publications dealing with organisation activities in general
50	26	8	reports from other international organisations
39	37	18	international treaties

48 Organisation and Use of Documents

481 Use of Document Number

Each reader was asked to mention the kind of organisation of different collection of documents in the DU Library system. The percentage of these who knew whether a document number would be helpful in finding the documents published by UNESCO, the League, and the OAS, is given below.

Particulars	UNESCO	LEAGUE	OAS
KNEW	21	37	37
DID NOT KNOW ..	37	18	13
DID NOT ANSWER	42	45	50

482 Use of UN Index

Each reader was asked to indicate the number of times he had used the UN index. Result:

18 per cent did not answer;
39 per cent said never;
11 per cent said once;
32 per cent said a few times;
no one indicated that he had used the index often.

483 UN Publications

The following group of questions were only to be answered by readers who made a positive response to the previous question. Only 16 readers responded, and the percentages used are based on 16 = 100 per cent. Each reader was asked what information was useful in locating certain types of information in UN publications. The following table indicates the percentage of responses for different types of documents.

Particulars	Sales number	Document number	Session, year, vol, agenda item	Don't know
Items in the official record of a session	0	31	37.5	31
Resolutions	0	25	44	31

Particulars	Sales number	Document number	Session, year, vol, agenda item	Don't know
*Official documents	0	50	25	31
Sales publications	31	12.5	6.5	50

*One reader answered this question two ways, and that is why the percentage is more than 100.

These 16 readers were asked to identify a sales number. Only 12.5 per cent were able to answer correctly. (This represents only 5 per cent of the entire population who answered the questionnaire.)

Each reader was asked to mention how the UN sales office organises its sales numbers, and also how the DU Library system organises them. Result in percentage:

Particulars	Knew	Didn't know	Didn't answer
UN sales office ..	5	74	21
DU libraries ..	0	71	29

484 Awareness of Circulation Policy

Each reader was asked if he was aware of the circulation policy for publications of international organisations. Result:

Publications of	Yes	No	No answer
UN	26	52	21
League	13	63	23
OAS	18	61	21
Other organisations	18	61	21

485 Use of Card Catalogue

Each reader was asked how he used the card catalogue in finding the publications of international organisations and which method seemed to be more useful. Result:

Particulars	Yes	No	Didn't answer
Use subject approach ..	50	16	34
Use approach by name of organisation ..	61	8	31
Subject approach useful ..	21	32	47
Main entry (Author) approach useful ..	34	16	50

486 Suggestion Regarding Organisation of Documents

Each reader was invited to offer suggestions for improvement in the handling of publications of international organisations in order to facilitate their use. The following seven comments were offered:

1 It is embarrassing to show ignorance in the questionnaire.

2 One reader said he has no need to use such publications, and therefore could not offer any constructive criticism.

3 The library staff should know how to use the materials, or the material could be indexed by computer; at any rate, about 95 per cent of the students never use anyway.

4 The reader needs an explanation of how to use the UN index.

5 The material is not of daily concern to the GSIS student; also, can the library staff adequately answer these questions?

6 One reader has had no need so far; some of the needed materials are placed on reserve by the professor requiring their use; and the librarian could be consulted in any case.

7 The basic information could be included in the handbook which GSIS students get during their library tour.

5/6 ANALYSIS OF RESULTS

5 ANSWERS REGARDING ACADEMIC STATUS AND SUBJECT INTEREST

51 Academic Status

It was found that academic status was not significant because the results on the remaining questions did not follow a pattern based on the extent of course work and research which had been completed. Rather, the subject of interest tended to influence the need for studying international organisations and their work. Also, it was difficult to determine the actual number of first and second year students within the population. The criteria for making this determination are subjective in that the number of course hours or the number of months could be used in deciding status. This specific information was not requested for and was not available to us.

52 Specialisation

521 Subject

In naming subject ofspecialisation, one hundred three responses were received. Because of the wide variation of responses and the apparent lack of uniformity in terms, it was difficult to clearly define the relationship between subject of specialisation and competence in the use of publications being considered.

If a study to determine the relationship between subject of specialisation and knowledge of the populations is to be taken up, then the questions on subject of spccialisation should be more detailed. A definition

of subject of specialisation would need to be prepared, and the relationship would have to cut across subjects since it is the policy of the Graduate School of International Studies to allow each individual to select his own field for subject specialisation. The objective of the present study was to determine the competence of the population in using publications of international organisations, not to study the relationships stated above. These two questions were included to determine if major trends existed.

522 Organisation

In the question concerning which organisations might be pertinent to the study, NATO was inadvertently omitted. When other organisations were listed which might be useful, four persons mentioned NATO. There is a large body of information available from NATO, but apparently not many readers find its study necessary, because only 11 per cent added it to the list.

In general, approximately one third of the population expressed an interest in the organisations listed. There were a few extreme cases. In the case of IMCO, IAEA, ICAO, ITU, and WMO, the percentage of persons interested in them is very small. On the other hand, such organisations as IBRD, OECD, UN, and UNESCO are of interest to a large percentage of the population.

When the population was given the opportunity to mention organisations other than those mentioned in the questionnaire, twenty-seven names were added. Some, such as OAU, were considered for the study, but dropped subsequently because of the extremely limited number of

documents currently available in the DU library system. Others, such as UNCTAD, were not included because they are organs of larger organisations that were included in the master list.

In analysing the results of the question about locations of documents in the DU library system, it was found that 57 per cent of the readers who said they were interested in specific documents, were able to identify its location.

6 ANSWERS TO LIBRARY-RELATED QUESTIONS

61 Location of Documents

The location of UN documents appears to be almost common knowledge of the readers who responded. This is probably due to the bulk of shelf space devoted to UN documents.

62 Classification and Cataloguing

Concerning the question on documents classified by Dewey or LC, it became obvious that not many readers were aware that the UN documents and documents of the OAS and of the League of Nations were not classified. 84 per cent of the population, who responded, said they might have need to use the UN documents, but only 13 per cent knew that the collection was not classified. 34 per cent said they might need OAS material, but only 5 per cent knew it was not classified. It is impossible to determine from the data at hand why readers do not know which material is not classified. Two possibilities are that readers have never used the documents in question or that they do not understand what is LC or Dewey classification.

Regardless, it is evident that readers do not know, and that this information is necessary for use in document search.

63 UN Documents

631 The data about knowledge as to where an index to UN publications was located compare closely with the percentage of readers who said that they have used UN publications -- that is, 63 per cent compared to 61 per cent. There was formerly an index in the Reference Room in MRL. Therefore the readers who gave this response cannot be considered wrong. Incidentally, two readers admitted guessing at the location.

632 Only 24 per cent of the respondents knew where the shelf list of UN documents was located. The shelf list may be used in finding documents, but 39 per cent of the population did not know the definition of a shelf list. Naturally, they did not know how to use it.

64 League Documents

641 In regard to the documents of the League of Nations, the same general conclusions as were for the UN documents could be drawn. Fifty per cent of the respondents did not answer these questions, and those who did answer might have made reasonable guesses due to the clearly defined nature of the documents. Only 11 per cent knew that a shelf list of the League publications existed.

642 Since an index to the League publications did not exist, it is evident that some readers were guessing. Due to the wording of this question, the guessing is evident. This leads to the possibility that guessing

might have been done in regard to the other questions as well but it was not so obvious.

643 In general, the data indicate that the faculty used publications of international organisations far less than the students. The only case in which this was not true is the OAS publications. The Latin American specialist on the faculty represents 12.5 per cent of the faculty who responded; 12.5 per cent of the students who responded would amount to four students. Judging from the wide variety of subject specialisations listed earlier, this would be a large portion of the student body to be interested in one particular subject. In terms of frequent use (six or more times), there is no significant difference between faculty and students.

At any rate, use of such documents is extremely limited. Possible reasons for this are as follows:

1 The reader may be ignorant of the existence of the documents.

2 In many subjects of study, the use of such documents is not applicable to any significant degree.

3 Some readers may not realise that they have used such publications. For example, OECD documents are catalogued and look like monographic material to the reader.Periodical publications may not be thought of as a publication of an international organisation.

4 It is possible that some of the documents can be found in other sources. However, the only two items known to be reprinted in textbooks are the League of Nations Covenant and the United Nations Charter. Some information about UN members and similar information on other organisations is available in certain reference tools. For example, the Yearbook of International Organisations lists organisations and gives membership information.

65 Frequency of Use

A choice was available concerning the number of times documents had been used in order to cover the possibility that the documents had been used more extensively than we expected. The only cases in which 33 per cent of the population had used the publications were the OECD and the UN. Therefore, the differentiation between the number of times used was not significant because of the very limited use of the majority of the documents.

66 OAS Publications

The answers to the questions concerning the OAS documents are not surprising in view of the fact that only five readers indicated that Latin America was one of their areas of study. The format of the documents was known to many more readers than the number of readers who expressed an interest in them.

67 Types of Publications

When readers were asked to tell what they knew about the kinds of documents in the publications of the UN, League, and OAS, it was found that much more was known about the UN than the other two. Here, as in other cases, a certain degree of guessing is suspected because of the number of incorrect responses.

68 Organisation and Use of Documents

681 Use of Document Number

When considering the document numbers of these three groups of publications, it becomes evident that few readers understand the systems of organisation.

Approximately 50 per cent of the respondents did not answer these questions about document numbers and those who did, indicated some confusion.

682 Use of UN Index

The use indicated of the index to UN publications presents some interesting facts. More readers said they had used the index than those who said they had used UN publications. This is an obvious example of reader's confusion because the UN index is a UN publication.

683 Finding UN Publications

Questions concerning the information to be found in the UN index and in the UN shelf list reflect an extensive lack of knowledge on the part of the readers. Very few readers were able to state what information in the UN index is helpful in search for documents of interest and the shelf list is rarely consulted.

684 Awareness of Circulation Policy

Judging from the few number of readers who said they understood the circulation policies for various types of publications of international organisations, it is apparent that either the publications get little use or that the readers were not aware that the documents they were using was a publication of an international organisation.

685 Use of Card Catalogue

The predominant approach in using the card catalogue (Dictionary type) for identifying publications of international organisations is the main entry for the organi-

zation. The respondents indicated that this approach is more useful than the subject approach. This could explain why the existence of some kinds of documents is unknown. The subject approach would give information on the various types of documents. In using the main entry approach, the reader must have some particular document in mind beforehand and then search for that type of material within the publications of the particular organisation.

686 Suggestions Regarding Organisation of Documents

In reviewing the suggestions made by the respondents concerning this study, it was decided that much unfounded speculation would be involved in determining the reasons behind the remarks. When the comments were directly related to the objectives of the study, they were considered in formulating the conclusions and recommendations.

7 CONCLUSIONS

This section of the paper is orientated toward the construction of a tool which will be of help to the specific reader group considered and possibly other readers as well.

71 In general, the survey indicates that the readers definitely lack in knowledge of the documents being considered and of their possible use in research.

72 The reader has indicated that he is interested in a broad range of international organisations and that he does not have a clear understanding of the structure within the organisations and the inter-relationships between the organisations. Therefore, any tool to guide

the reader in the use of the publications of international organisations should first mention a source, such as the Yearbook of international organisations, which will help to clarify the workings of organisations and their place in the structure of international organisations.

73 Another general problem is that the reader is unaware of the types of documents which are available among the publications. In this instance, the reader is missing some good sources of particular kinds of information, such as statistics and bibliographies. In order to remedy this situation, a chart is suggested which would incorporate the following information: the name of the organisation, the circulation policy for the documents, the classification used, the existence of an indexing service, and the specific kinds of information available from the organisation within the DU Library system. The chart or grid set-up is suggested because it brings the information into one listing, is simple to use, and eliminates many of the elementary and repetitious questions of readers concerning the documents. It also solves the card catalogue problem of an inadequate subject approach. While the chart will not delineate specific narrow subjects dealt with in the documents, it will indicate the specific type of documents which the reader may need and also the existence of an indexing service provided by that organisation. In this way, the reader is made aware of the most direct approach to finding documents of each organisation and of possible approaches to the same type of documents published by other organisations.

74 In most cases, frequent use of the publications of any given organisation is made by only a

small percentage of the readers. One of the comments on the questionnaire pointed out that it should be a function of the library staff to be aware of the intricacies of use of the documents. In general, this is true. However, in special cases the tool could contain information on specific organisations which is needed by every reader or a large number of readers. The case of the UN publications demonstrates this point. The index and shelf list are very complex, but each reader will need to consult one or both to find his information.

75 Within the framework of this study, no further research is required. In two instances, further research was indicated. We found it impossible to determine the effect of the level of study on the extent of knowledge. There was also no correlation between subject of study and use of documents. The questionnaire method could be used for both of these subjects.

76 In studying related types of documents, the same procedure could be adopted. For example, the knowledge of publications of the US government and of foreign governments could be studied and a similar tool prepared, if necessary. This would be particularly helpful.

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PATTERN OF USE AND SEARCH FOR DOCUMENTS BY SPECIALISTS: A CASE STUDY THROUGH CITATION ANALYSIS, QUESTIONNAIRE, AND INTERVIEW.

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/Information gathered on the pattern of use of and search for, documents by eleven specialists preparing review articles is presented. The survey was done in a university-cum-research type institution, using the methods of citation analysis, questionnaire, and personal interview. The main points in the comments and suggestions by the specialists during the interview are given. The implications of the findings of the survey to the library of the institution where the survey was conducted, are mentioned/.

1 OBJECTIVE OF STUDY

The main objective of the study reported in this paper is to gain information about the ways in which specialists search for documents relevant to the subjects of their respective interest.

2 PROCEDURE

21 Preparation of Review Article by Specialist

The procedure adopted was to study the method used by specialists in searching for documents for preparing a review article in a specific subject.

This procedure was adopted because in preparing a review, the specialist has to necessarily base his report on published documents even though he may include his critical comments in the review. Further, a review should be pinpointed (that is, minimum of noise and irrelevancy), exhaustive (that is, minimum of leakage) and prepared for publication on time.

22 Stages

The survey involved three stages of work.

221 Stage 1

The steps in stage 1 consisted of

1 Selection of review articles and analysis of bibliographical citations in each of them;

2 My preparing a bibliography on the same subject as covered by the review; and

3 Comparison of the references in this bibliography with those cited by the reviewer in respect of relevancy and number of papers.

222 Stage 2

The steps in stage 2 consisted of

1 Framing a questionnaire;

2 My meeting the reviewers and filling up the questionnaire; and

3 Analysis of the information collected through questionnaire and dialogue with the reviewers.

223 Stage 3

Consideration of the special points arising from the work done in stages 1 and 2.

3 CITATIONS IN REVIEW ARTICLES

31 Selection of Review Article

Eleven reviews published in Indian periodicals were chosen for the survey. Out of these, two articles were selected as case study for the reasons that

1 The reviewers were available for consultation/ discussion whenever required; and

2 Each review contained a fairly large number of citations.

The reviews selected for case study were:

1 KASI VISWANATH (G) and PILLAI (S C). Occurrence and activity of protozoa in soil. (J sci industr res. 27;1968;187-95); and

2 CHERAYIL (J D). Transfer ribonucleic acid and the genetic code. (J sci industr res. 27;1968; 106-17).

The first review covered a long period of time from about 1670 to the end of 1966 -- while the second review covered a shorter period of time, as could be determined from the citations in the bibliography appended to each of the reviews.

32 Analysis of Citations

The citations given at the end of each of the review articles were analysed and tabulated as follows:

1 Number of articles per periodical;

2 Year-wise distribution of articles;

3 Subject-wise distribution of periodicals cited and number of articles published in each subject;

4 Country-wise distribution of the periodicals cited;

5 Author-wise distribution of articles

51 Self_citation; and

52 Others;

6 Single and multiple authorship.

The tabulated data are given in Appendix 1.

33 Preparation of Bibliography

331 Searching in Chemical Abstracts and Biological Abstracts

In preparing a bibliography on the subjects of the review articles mentioned above, I used the Chemical abstracts (=CA) and the Biological abstracts (=BA) to collect references. It was obviously more convenient to use CA as it provides decennial indexes. In the case of BA, it was necessary to search through each volume as it does not provide a cumulative index.

The search in the first six volumes of BA brought out some interesting points. The article "The study of soil protozoa" (Beitrage zur Kenntnis der Boden Protozoan) by M Koffman, published in Acta zoologica, 7;1926;277-328, was abstracted by BA in 1927 (Abstract 12636) and by CA in 1928 (Abstract 2229). The authors of the review article "Occurrence and activity of protozoa in soil" have cited the CA reference of 1928 but not the earlier one in BA. One of the reviewers on request for a clarification about this point,

pointed out that he did not search thoroughly BA as he did in the case of CA, mainly because the former did not provide any cumulative index. He further added that he could quote only the CA reference because of the non-availability of the periodical in which the article was published.

In the light of the above experience, I did not search BA as thoroughly as I did CA. However, references were collected by searching the following volumes of BA: 1 to 6 (1926-32);33(1959); 37(1962); 41(1963); 46 (1965); 47(1966)

332 Record of the articles selected

Full bibliographical details of each of the articles deemed to be relevant to the subject of reviews but not cited in the bibliography given in the reviews, were recorded on standard catalogue slips. A total of 63 such articles were selected, 24 from CA and 39 from BA.

34 Comment by Specialist

I met the reviewer and mentioned to him about the 63 articles not cited in his bibliography. I also explained to him the purpose of my meeting him on this subject. The specialist took all the 63 references and returned them after about a month with the following comments:

SN	Particulars		Remarks of the specialist
1	Articles in BA	39	Did not consult BA at all
2	Articles in CA	24	
21	9 articles		No remarks
22	10 articles		Not relevant
23	4 articles		Later included
24	1 article		O K (✓)

During the interview the specialist said that although in some of the abstracts, the term "protozoa" occured, the article was found to be not relevant to the specific subject of the review. He also expressed the difficulty in the use of BA because it does not provide cumulative index.

4 QUESTIONNAIRE AND INTERVIEW

41 Specialists Interviewed

The specialists interviewed were selected from among the research workers/teachers in a university-cum-research institution. These specialists were those who could be easily approached, who have written review articles and who were frequent users of the library. The following table gives information about the subject background of the specialists:

SN	Colon Class Number	Subject of specialisation	Number
1	9C	Scientific Instrumentation	1
2	C	Physics	1
3	D6	Mechanical engineering	1
4	E1	Inorganic and Physical Chemistry	1
5	E5	Organic chemistry	1
6	F1	Chemical engineering	2
7	GX	Biochemistry	4
		Total	11

The following table gives information about the academic status of the specialists:

SN	Academic status	Subject of specialisation	Number
1	Professor	Biochemistry	1
2	Assistant Professor	Chemical Engineering	1
3	Lecturer	Scientific Instrumentation	1
		Physics	1
		Mechanical Engineering	1
4	Senior Research Assistant	Biochemistry	1
		Inorganic and Physical Chemistry	1
5	Research Scholar/ Student	Chemical Engineering	1
		Biochemistry	1
		Organic Chemistry	1
6	Outsider (Retired Assistant Professor)	Biochemistry	1
		Total	11

42 Meeting the Specialist

A copy of the questionnaire used in collecting information is given in Appendix 2. At first when copies of the questionnaire were distributed to a few specialists, the response was very poor. And even in thecase of one or two questionnaires returned after completion, the questions were not adequately answered. Therefore, I personally met each of the specialists, explained to them the objectives of the survey and gave some guidanc in answering the questionnaire. This dialogue brought fruitful results. For, the specialists evinced keen interest in the survey and extended full cooperation. In a few cases, I myself filled the questionnaire on

the basis of the dialogue I had with the specialist.

The time taken for an interview varied from 30 minutes to 3 hours. A more or less full account of the dialogue with each specialist was kept.

5 ANALYSIS OF REPLIES

51 Structure of Questionnaire

From the questionnaire (See Appendix 2) it may be seen that Question 1 is a generic or comprehensive one. The other questions are actually subdivisions to Question 1 although it is not so indicated in the questionnaire. The eleven specialists interviewed were each explained about this. The number of answers and comments, if any, for each question are mentioned below.

52 Question 2

521 Statement

Do you use (1) The references cited in the bibliography to a comprehensive article; (2) Indexing and abstracting periodicals; (3) Other source, in searching for documents for the review article.

522 Reply

SN	Source used	Number
1	Reference cited in a comprehensive article	5
2	Abstracting/indexing periodical	5
3	Guide's collection	1
	Total	11

523 Annotation

1 One of the reviewers said he collected the references first by scanning through Current contents and similar indexing periodicals, then the learned periodicals specifically dealing with the subject, followed by a search in abstracting periodicals for comprehensive coverage.

2 Another reviewer (research scholar) mentioned that he found it convenient to use the collection of documents on the subject available with the guide and then up-date it through further search of the appropriate abstracting and indexing periodicals.

3 A third reviewer said he consulted an article in ane encyclopaedia to get an idea of the overall scope of the subject and noted the documents cited in the articles in the encyclopaedia. The abstracting periodicals were then searched using the subject headings noted from the encyclopaedia.

4 Another specialist emphasised that it is necessary first to determine the subject headings under which the abstracting periodical to be searched would arrange the articles of interest to the user.

53 Question 3

531 Statement

Do you use published bibliographies available in our library or elsewhere?

532 Reply

SN	Source used	Number
1	Used the bibliographies available in the library	3
2	No bibliography exists on my subject	1
3	Bibliographies available elsewhere	1
4	Partly used this source	3
5	Did not use this source	2
6	No comment	1
	Total	11

533 Annotation

Most of reviewers were not aware that the library would prepare comprehensive bibliographies on specific subjects on request. They were also not aware that several such bibliographies had already been prepared and available in the library either in mimeographed or printed form. The reason was that these documents have not been catalogued.

54 Question 4

541 Statement

Do you ask for help from the library in document search and preparing bibliography on the subject of the review?

542 Reply

SN	Use of Library	Number
1	Do not ask the library for such help	3
2	Ask when necessary	1
3	Do not know that such a service is available in the library	5
	Total	11

543 Annotation

1 As a result of the discussion on this point with the reviewers, the following day the library received a request for the preparation of bibliographies on ten different subjects. These bibliographies were required in connection with the allotment of subjects for research in one of the Departments. Another lecturer made a request for bibliographies on three subjects in connection with his own research programme.

2 Two specialists, now employed elsewhere, who were research workers in the organisation, having come to learn of the facility, said that they would pay for the service if extended to them.

55 Question 5

551 Statement

Do you get the document search done by your assistants and, if so, do you make a selection of the documents brought to you?

552 Reply

SN	Method of Search	Number	Status of Specialist
1	Search by assistants	4	Teacher
2	Searching by oneself	7	Student
		11	

553 Annotation

1 One of the research assistants said that only occassionally he had searched for documents for the teacher / guide. For example, when the teacher/guide

had read an article but had not made a note of the details.

2 A selection of the documents is made by the teacher/guide after the documents in the bibliography have been read in the original or in an abstract.

56 Question 6

561 Statement

Do you maintain a personal file/record/catalogue of the documents of interest to you?

562 Reply

SN	Method	Number
1	First on cards and then transferred into a note book	7
2	First in notebook and then transferred on to cards	4
	Total	11

57 Question 7

571 Statement

What are the varieties of documents do you usually consult for preparing the review?

572 Reply

SN	Variety of documents	Number
1	All varieties of ocument which yield relevant information	5
2	Selected documents	6
	Total	11

573 Annotation

"Selected documents" exclude technical reports, patents, standards etc. This depends on the subject of review. For example, a subject in the field of engineering or technology would require the use of such documents much more than a subject, say, in the biological sciences.

58 Question 8

581 Statement

What other methods do you generally use for information about the subject of the review?

582 Reply

SN	Source of information	Number
1	Attending conferences and seminars. Correspondence with peers and colleagues who have similar subject interest. Periodical discussions with peers and colleagues in the institution or elsewhere	7
2	No comments	4
	Total	11

583 Annotation

1 Although four specialists made no comments against this question, when the point was personally discussed, all of them disclosed that they were maintaining contacts with specialists in the subject in the country and abroad through correspondence,

exchange of reprints etc.

2 All the eleven specialists interviewed emphasised the need for direct contact among research workers either through correspondence or at meetings and seminars.

591 Question 9

5911 Statement

Do you think that you have been able to cover all the relevant documents in your review? If not, what you think is the reason for your inability to cover exhaustively?

5912 Reply

SN	Coverage	Number
1	Exhaustive coverage has been possible	8
2	Only selective coverage	3
	Total	11

5913 Annotation

1 Four specialists commented that "exhaustive coverage" and "selective coverage" are relative terms, and the interpretation may vary from one person to another. For example, "exhaustive" may mean all the documents on the subject or it may mean all the documents that are relevant to and contribute to the development of the subject.

2 A research student mentioned that exhaustive

coverage would also depend on the reviewer's thorough knowledge of the subject and the source documents. He added that there may be few documents on some subjects of great intension -- such as, Mathematical approach to steroidal synthetic intermediates.

3 Three of the specialists said that the kind of review prepared depends on the subject of the review, the periodical in which it is to be published, and the specialists group for whom the treatment is to be oriented.

592 Question 10

5921 Statement

How do you usually get over the problem of studying articles in languages not known to you?

5922 Reply

SN	Source of translation	Number
1	Foreign Language Department of the institution, and Insdoc	10
2	As in (1) plus persons -- Indian or foreign -- working in other institutions	1
	Total	11

5923 Annotation

1 Most of the specialists interviewed mentioned that the specialists working in one and the same subject field are usually known to each other, and

they exchange preprints, translations of articles or of abstracts in advance of publication.

2 All the specialists expressed concern about the inordinate time lag in obtaining translations through Insdoc. Some attributed this time lag as the reason for the inadequate coverage of documents in the review.

3 Several specialists emphasised the need for an appropriate subject-language competence in the translator of scientific and technical papers.

593 Question 11

5931 Statement

Do you think that a discussion of the review article among your colleagues is necessary before publication?

5932 Reply

SN	Need for discussion	Number
1	Yes	7
2	No	4
	Total	11

5933 Annotation

1 Opinion was rather sharply divided on this question. Some of the specialists argued that only an original article need to be discussed before publication. For, the reviewer is mainly concerned in arranging the ideas in a preferred sequence so

so as to show the main lines of development of the subject and the trend. He may, of course, add his own critical views on the subject of the articles reviewed, if necessary.

On the other hand the senior teachers stressed the point that any publication -- whether an original article or a review -- should be discussed among the subject specialists so that any inadequacy in it can be corrected before publication.

6 SUGGESTIONS BY READERS

In the course of the survey some suggestions have been made by some of the specialists interviewers. Two of these are mentioned below:

1 Two of the specialists interviewed suggested that the services of the library should be made more widely known to students and members of the faculty, through programmes, suitable talks by the library staff, handouts, displays etc.

2 There was also a suggestion from some specialists that the library should get a few important periodicals by air mail so that research workers are kept abreast of the important developments in the field without the undue delay involved in the transmittal of foreign periodicals by surface mail. One of the Assistant Professors narrated the following incident in this connection. When one of his students published a review article, he received a comment from his foreign counterpart that an important

article published in a then recent issue of Nature had not been included in the review. The teacher and his student immediately checked up with the library but were disappointed to find that the issue had not been received. This is because it takes some twelve weeks for British and American periodicals to reach India by surface mail.

7 CONCLUSION

While it is inexpedient to generalise on the basis of this small survey, a few points are noteworthy for the institution where the survey was carried out.

1 The liaison and communication between the library and the potential users are inadequate. Many of the readers are not aware of the services available from the library.

2 Once the readers came to know about the bibliographical services that can be had from the library on request, they were eager to make good use of the services.

3 Although, to begin with, the response to the questionnaire was poor, when the purpose of the survey was explained to the specialists, the latter evinced keen interest and extended cooperation.

8 ACKNOWLEDGEMENT

I am grateful to Prof A Neelameghan for suggesting the work reported here and for the help in developing the paper. I am also thankful to Dr E S Rajagopal, Librarian-in-Charge, Indian Institute of Science, for his interest in the survey and for permission to contribute this paper to the DRTC Seminar (9)(1971).

91 APPENDIX 1

Tables 1 to 6 present data from the analysis of citations in the review article CHERAYIL (J D). Transfer ribonucleic acid and the genetic code (J sci industr res. 27;1968;106-17).

Table 1. Distribution of Citations by Periodical Publication

SN	Title of periodical	N of citations
1	Agr biol chem (Japan)	1
2	Angew chem	2
3	Annual rev biochem	8
4	Arch biochem biophys	1
5	Biochem biophys res commun	11
6	Biochemistry	12
7	Biochem j	4
8	Biochem soc symp	1
9	Biochem zeit	1
10	Biochim biophys acta	32
11	Canad j biochem physiol	4
12	Cold Spring Harb symp	2
13	Dokl Akad Nauk SSR	1
14	Feder proc	5
15	Ind j biochem	1
16	J Am Chem Soc	5
17	J biol chem	33
18	J cell comp physiol (suppl 1)	1
19	J chromat	1
20	J molec biol	27
21	Meth enzym	1
22	Nature	5
23	Physiol plan	1
24	Proc Nat Acad Sci USA	28
25	Progr nucl acid res	2
26	Rev biochem	1
27	Science	9
28	Sci Amer	1
29	Virology	1
30	Book	2
	Total	204

182

Table 2. Yearwise Distribution of Citations

SN	Year	Number of citations	Percentage
1	1967	13	6.4
2	1966	32	15.7
3	1965	39	19.1
4	1964	26	12.7
5	1963	25	12.3
6	1962	22	10.8
7	1961	13	6.4
8	1960	9	4.4
9	1959	10	4.9
10	1958	2	0.98
11	1957	1	0.49
12	1956	3	1.47
13	1955	2	0.98
14	1951	1	0.49
15	1945	1	0.49
16	In press	5	2.4
	Total	204	100.00

Table 3. Distribution of Citations by Subject of Host Periodicals

SN	Colon Class N	Subject	N of citations	%
1	A	Natural science	44	21.63
2	E	Chemistry	5	2.4
3	E3	Analytical chemistry	1	0.49
4	F	Technology	2	0.98
5	G	Biology	7	3.43
6	GT	Cytology	1	0.49
7	GV	Microbiology	1	0.49
8	GWA	Molecular biology	143	70.09
		Total	204	100.0

183

Table 4. Countrywise Distribution of Host Documents

SN	Country of publication of host document	N of articles	%
1	USA	120	58.83
2	UK	37	18.14
3	Netherlands	35	17.15
4	Canada	4	1.96
5	Germany	3	1.47
6	India	2	0.98
7	USSR	1	0.49
8	Japan	1	0.49
9	Denmark	1	0.49
	Total	204	100.00

Table 5. Distribution of Citations by Author

SN	Author	N of citations	%
1	Self citation	10	4.9
2	Other authors	194	95.1
		204	100.0

Table 6. Distribution of Citations by Number of Authors per Article

SN	N of authors	N of articles	Percentage
1	1 (single)	35	17.13
2	2	81	39.70
3	3	54	26.46
4	4	15	7.40
5	5	8	3.92
6	6	6	2.94
7	7	3	1.47
8	8	1	0.49
9	10	1	0.49
	Total 204		100.00

Tables 7 to 12 present data from the analysis of citations in the review article PILLAI (S S) and KASI VISWANATH. Occurrence and activity of protozoa in soil. (J sci industr res. 27;1967;187-95).

Table 7. Distribution of Citations by Periodical Publication

SN	Title of periodical	N of citation
1	Acta microb polon	2
2	Acta zool hungar	1
3	Agroken talajt	2
4	Ann appl biol	8
5	Biol abstr	25
6	Bull Nat Inst Sci India	1
7	Canad j microb	1
8	Chem abst	6
9	Comp ren hebd Sc Acad Sc	1
10	Cur sci	5
11	Industr eng chem	1
12	Ind med gaz	2
13	J agri res	2
14	J agri sci	8
15	J bact	2
16	J gen microbiol	2
17	J Ind Inst Sci	1
18	J Roy Sant Inst	1
19	Nature	7
20	New Zeal j agri res	2
21	Pedabiolojica	1
22	Proc Ind Sci Congr	1
23	Proc Roy Soc	5
24	Proc Soil Soc Amer	1
25	Phil trans Roy Soc	4
26	Sci and culture	3
27	Soil sci	12
28	Surv munic eng	1
29	Universitas	1
30	Zentr bakt paras kunde	6
31	Book	10
32	Intern Conference reports	8
	Total	133

185

Table 8. Year-wise Distribution of Citations

SN	Year	N of citations	%	SN	Year	N of citations	%
1	1966	2	1.50	27	1932	1	0.75
2	1965	1	0.75	28	1931	5	3.70
3	1964	4	3.00	29	1930	4	3.00
4	1962	1	0.75	30	1929	7	5.20
5	1961	2	1.50	31	1928	8	6.00
6	1960	4	3.00	32	1927	7	5.20
7	1958	2	1.50	33	1926	1	0.75
8	1956	1	0.75	34	1925	1	0.75
9	1955	2	1.50	35	1924	1	0.75
10	1953	3	2.20	36	1923	3	2.20
11	1952	2	1.50	37	1920	2	1.50
12	1951	1	0.75	38	1919	1	0.75
13	1949	1	0.75	39	1918	2	1.50
14	1948	3	2.20	40	1917	2	1.50
15	1947	2	1.50	41	1916	4	3.00
16	1946	3	2.20	42	1915	9	6.75
17	1945	2	1.50	43	1914	5	3.75
18	1944	1	0.75	44	1913	5	3.75
19	1943	2	1.50	45	1912	1	0.75
20	1942	1	0.75	46	1911	2	1.50
21	1941	1	0.75	47	1909	2	1.50
22	1937	6	4.50	48	1906	1	0.75
23	1936	1	0.75	49	1877-8	1	0.75
24	1935	4	3.00	50	1703	2	1.50
25	1934	2	1.50	51	1677	1	1.50
26	1933	1	0.75				
					Total	133	100.00

Table 9. Distribution of Citations by Subject of Host Periodical

SN	Colon Class N	Subject	N of citations	%
1	z	Generalia	1	0.75
2	A	Natural science	29	21.75
3	D	Engineering	4	3.00
4	E	Chemistry	9	6.75

SN	Colon Class N	Subject	N of citations	Percentage
5	F	Technology	1	0.75
6	G	Biology	47	35.50
7	J	Agriculture	36	27.00
8	K	Zoology	4	3.00
9	L	Medicine	2	1.50
			133	100.00

Table 10. Country-wise Distribution of Host Documents

SN	Country of publication of host document	N of articles	%
1	USA	51	38.50
2	UK	48	36.00
3	India	16	12.00
4	Germany	8	6.00
5	Hungary	3	2.25
6	Poland	2	1.50
7	New Zealand	2	1.50
8	Netherlands	1	0.75
9	Canada	1	0.75
10	France	1	0.75
	Total	133	100.00

Table 11. Distribution of Citations by Author

SN	Author	N of citations	Percentage
1	Self citation	18	13.6
2	Other authors	115	86.4
		133	100.00

Table 12. Distribution of Citations by Number of Authors per Article

SN	N of authors	N of articles	Percentage
1	1 (Single)	87	65.50
2	2	35	26.25
3	3	8	6.00
4	4	1	0.75
5	5	1	0.75
6	6	1	0.75
		133	100.00

92 APPENDIX 2

Proforma of Questionnaire

Name of Specialist :

Department and Status :

Review article
(Bibliographical detail) :
... ...

Q 1 How do you usually search for documents for preparing the review article. (See succeeding questions)?

Q 2 Do you use (1) The references cited in the bibliography to a comprehensive article; (2) Indexing and abstracting periodicals; (3) Other sources,

in searching for documents for the review articles?

Q 3 Do you use published bibliographies available in our library or elsewhere?

Q 4 Do you ask for help from the library in document search and preparing bibliography on the subject of the review?

Q 5 Do you get the document search done by your assistants, and if so, do you make a selection of the documents brought to you?

Q 6 Do you maintain a personal file/record/catalogue of the documents of interest to you?

Q 7 What are the varieties of documents do you usually consult for preparing the review?

Q 8 What other method do you generally use for information about the subject of the review?

Q 9 Do you think that you have been able to cover all the relevant documents in your review? If not, what you think is the reason for your inability to cover exhaustively?

Q10 How do you usually get over the problem of studying articles in languages not known to you?

Q11 Do you think that a discussion of the review article among your colleagues is necessary before publication?

DRTC Seminar (9)(1971). Paper BD.

USE OF DOCUMENTS BY NUCLEAR PHYSICISTS AND METALLURGISTS: A CASE STUDY.

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/Details of the procedure used in and a report of the findings of, a survey conducted by citation counting and interview, of the use of different varieties of documents by the scientists in the Nuclear Physics Division and Metallurgy Division of the Bhabha Atomic Research Centre, Trombay, Bombay (= BARC), are presented. Oral communication between scientists is an important channel for dissemination of information, particularly among the nuclear physicists. The periodical is the most frequently used source of information for both the specialist groups. Nuclear physicists make little use of patents and standards, but give high priority to technical reports. Many of the scientists are not adequately aware of the services available from the Technical Information Section. The implications of the findings of the survey to the documentation service in BARC are mentioned/.

1 INTRODUCTION

11 Scientific Research and Documentation Service

Scientific research is expensive. The practical application of the results of research can be even more expensive. Documentation service is relatively less

expensive. Through a continuous improvement of the efficiency of documentation service and helping specialists to make the best use of it, research and developmental potential can be conserved. A study of the use of documents by specialists can help in improving the efficiency of documentation tools and services.

12 Scope of the Paper

This paper reports the findings of a survey of the use of documents by specialists in Nuclear Physics and in Metallurgy in the BARC. The research work done by the nuclear physicist is more fundamental in character, whereas the work done by the metallurgist is usually for immediate application. It was, therefore, thought that this difference in the character of the research might show a difference in the use of documents by the specialists in the respective subjects.

2 SOURCE OF INFORMATION

21 Two Varieties

The sources of information for the specialist are mainly of two kinds:

1 Written; and 2 Oral.

Among the widely used sources are primary documents -- such as, book , article in periodical, technical report, conference proceedings, patent specification, and standards -- and secondary documents -- such as, indexing and abstracting periodicals, digest, review, state-of-art report and trend report. The degree of convenience with which such a document can be used by the specialist affects the overall pattern of use of documents.

22 Oral Communication

Nuclear physicists as well as metallurgists make considerable use of oral communication. The medium is not only convenient to use, but allows the research worker to discuss, clarify, and modify his information requirements in person. A research worker may find the discussion with and reaction of, a colleague or peer more helpful than reading published documents only. This is particularly so with nuclear physicists and metallurgists because they often seek information or techniques and procedures, equipment, negative aspects of a particular line of approach, etc. Further, the information flow in the oral communication network is usually about two years in advance of the publication of the same information in the form of an article, or report, or other document. For these reasons, a research worker often attempts to develop extensive personal contacts, including attending conferences, symposia and other meeting of specialists. However, establishing such contacts is expensive and, therefore, this source of information is not available to many. Further, only a few specialists may have opportunity to participate in the many conferences that may be held even in the restricted field of their specialisation.

23 Need for Study of Use of Documents

De Solla Price writes: "The pattern of bibliographical references indicates the nature of the scientific research front". He pictures, in the context of that special relationship which is given by the citation of one paper by another, a network of scientific papers, linking each published paper to the other papers directly

associated with it. It is estimated that, on an average, a scientist spends 10 to 15 per cent of his working time in reading. Therefore, it is necessary to study the document needs and information gathering habits of specialists with a view to improving the documentation service to readers and flow of information among them. An important finding of the studies of document use by readers is that the flow of scientific and technical information is by no means simple. Several factors alter the reader's information gathering habit. The nature of the organisation in which he works, his academic and professional attainments, the kind of work he is engaged in, and the field of specialisation, are some of these factors.

3 PROCEDURE

31 Two Lines of Approach

Two lines of approach were adopted in the survey -- namely,

1 Counting of bibliographical citations in documents authored by nuclear physicists and by metallurgists of BARC; followed up by

2 An interview of the specialists.

This procedure was found to be more helpful than the questionnaire-filling-up method, which usually brings forth few responses from the scientists.

32 Documents Used

The papers published by nuclear physicists and metallurgists during the period January 1969 to December 1970 were used for counting the citations. During this

period, the total number of papers published by all the BARC scientists taken together was 923. The papers contributed to Indian periodicals alone were considered. The total number of papers published by BARC nuclear physicists and metallurgists in Indian periodicals during the period, the citations in which were counted and analysed, was 140. Out of the 140 papers, 80 were by nuclear physicists and 60 by metallurgists.

33 Number of Scientists Interviewed

About 2,100 scientists are working in BARC. The Metallurgy Division has 104 scientists (5 per cent) and the Nuclear Physics Division has 106 scientists (5.1 per cent). The number of nuclear physicists interviewed was 60 -- that is, 56.6 per cent of the total number of scientists in the Nuclear Physics Division; and the number of metallurgists interviewed was 80 -- that is, 67 per cent of the total number of scientists in the Metallurgy Division.

4 FINDINGS OF CITATION COUNTING

41 Variety of Documents Cited

Table 1 gives data on the number of citations of different kinds of documents.

411 Table 1. Census of Citations

SN	Type of Document	Citation by			
		Nuclear Physicist		Metallurgist	
		N	% of 726	N	% of 860
1	Periodical	482	66.4	558	64.9
2	Technical report ..	114	15.7	74	8.6
3	Book	54	7.4	134	15.6
4	Conference proceedings	62	8.5	48	5.6

SN	Type of Document	Citation by			
		Nuclear Physic		Metallurg	
		N	% of 726	N	% of 860
5	Thesis	2	0.3	48	0.9
6	Patent	-	-	24	2.8
7	Standard	-	-	2	0.2
8	Unpublished work	12	1.7	12	1.7
	Total	726	100.0	860	100.0

42 Annotation

1 The average number of citations in a paper by a nuclear physicist is 9.1 and it is 14.4 in a paper by a metallurgist. One of the nuclear physicists remarked: "The problems with which we are concerned are very specific and not many scientists work on the same problem. Hence, there is not much published literature in the field". Citation practice can also vary with the historical background, the literary practice, and the classic, ephemeral and emerging nature of the subject, and also with the rate of progress of the subject. These factors may influence the selection of documents for citing in a paper.

2 Of the average number of citations, the average number of periodicals cited by the nuclear physicist is 7; this average is 11 for the metallurgist.

3 The metallurgist uses more varieties of documents than the nuclear physicist. For instance,

the nuclear physicist has not cited any patent or standard, whereas the metallurgist has done so. The reasons for this difference may be that the metallurgist needs to have a thorough practical knowledge of the properties and use of a variety of starting materials, and processes and techniques. Such information can often be found in standards, patents, and specifications.

4 The periodical publication is ranked first as a source of information both by the nuclear physicist and by the metallurgist. Further, the percentage of citations to periodicals is more or less the same for both.

5 The nuclear physicist ranks the technical report as the second most widely used source (15.7%), whereas the metallurgists ranks the book in this position (15.6%). One reason for this difference may be that the nuclear physicist finds the results of research in his field published much earlier in technical reports than in books; On the other hand, the metallurgist may feel that the technical report does not give all the details he needs about the product or process of his interest. Further, nuclear physics is a highly specialised subject developing rapidly during the last two decades, and is hiving off from the classical areas.

5 INTERVIEW

51 Questions

The questions posed to the metallurgists and nuclear physicists interviewed were as follows:

1 Average time spent each day in reading documents relating to the subject of interest;

2 Average number of times the Library (Central and Divisional) is used per day;

3 The variety of documents used when faced with a specific problem; and

4 Variety of documents used for current awareness purposes.

52 Findings

Fig 1 visualises the comparative data about priority ranking of different varieties of documents by metallurgists and nuclear physicists, in a graph.

(Fig 1. Graph See next page)

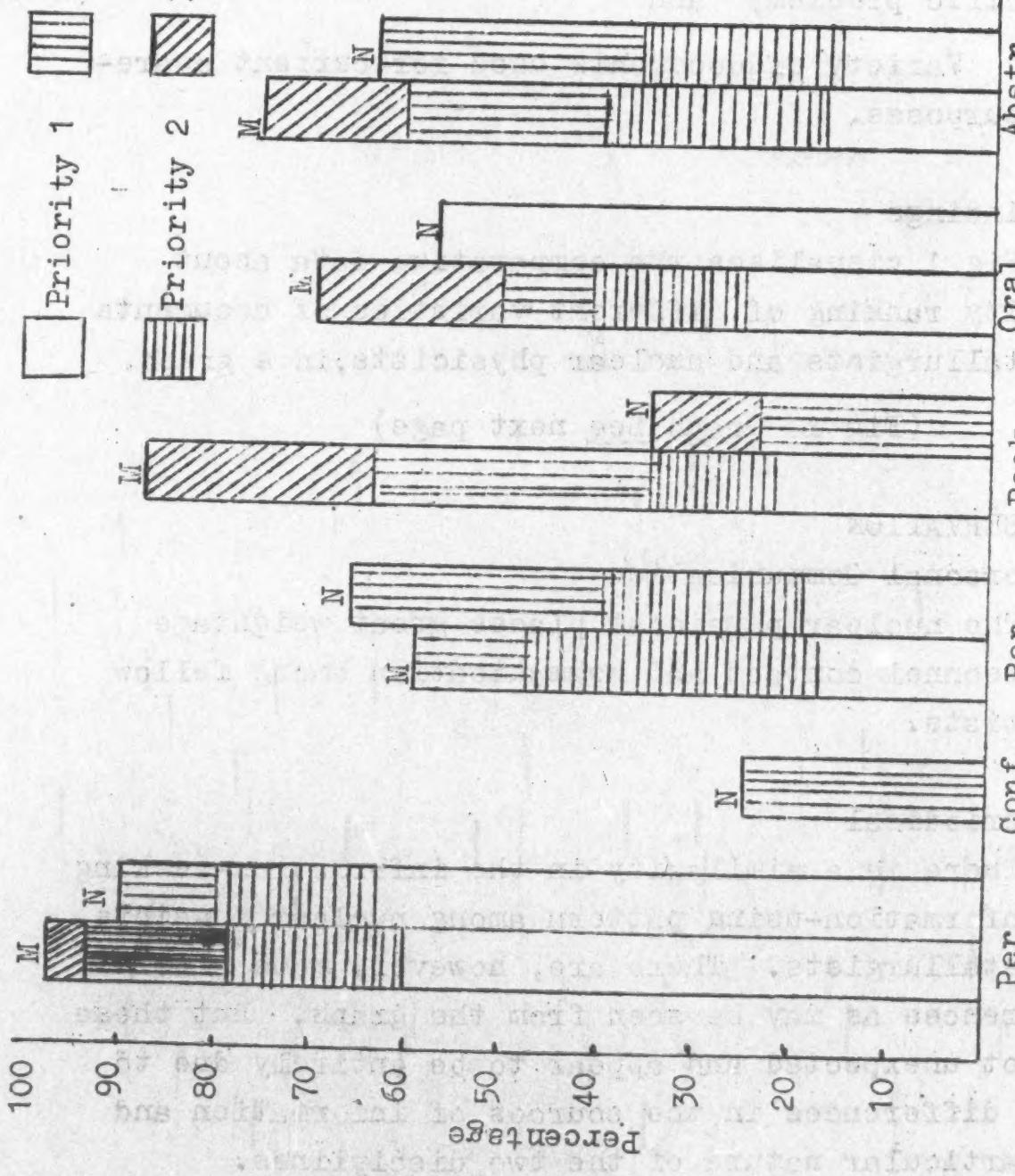
6 OBSERVATION

60 Personal Communication

The nuclear physicist places great weightage on personnel contact and communication among fellow scientists.

61 Periodical

There is a similarity in the information-seeking and information-using pattern among nuclear physists and metallurgists. There are, however, some minor differences as may be seen from the graph. But these are not unexpected and appear to be entirely due to known differences in the sources of information and the particular nature of the two disciplines.



Type of document

Fig 1. Preference for variety of documents

Both metallurgists as well as nuclear physicists predominantly use periodicals falling in their respective subjectfields only. The specialist is very particular in going through each issue of the periodical of his preference as soon as it is received in the library. One metallurgist, in fact, said that he used only one particular periodical and whenever a specific research problem came up he would rather refer to the cumulative index of that periodical than search in other periodicals!

62 Technical Report

The findings by citation analysis regarding the use of technical reports is confirmed by the interview (See Sec 411, Table 1).

63 Conference proceedings

The nuclear physicist gives considerable importance to proceedings of conferences, seminars, symposia, etc. The metallurgist gives much less importance to such publications.

64 Patent

The nuclear physicist makes little use of patents because,

1 The patent does not usually present the process or experiment in a scientific way; and

2 The patent is more of legal interest and more useful in an industrial organisation than in a scientific research institution.

65 Book

Books may be categorised as textbook, handbook and data book. The handbook is frequently used for factual information. The textbook is of limited use. And within this limit, the metallurgist uses it more often than the nuclear physicist.

66 Standard and Specification

The work in BARC being largely research-oriented rather than product-oriented, standards and specifications are used to a very limited extent, for example, in designing pieces of equipment for use in a specific research project.

67 Thesis

Theses are not used to any appreciable extent mainly because of the difficulty of access to theses submitted to Indian universities.

68 Secondary Source

1 Current contents is widely used both for specific information about a paper as well as for current awareness. This periodical is received in BARC by air mail and scientists try to get reprints of particular articles of interest to them by writing to the respective authors. In this way, they are able to learn about the current developments in their respective subjects even earlier to the receipt of the periodicals carrying these articles in BARC.

2 A metallurgist collects all available factual

information -- for example, on properties of materials, and processes and techniques used -- before starting work on a project. Therefore, he makes good use of abstracting and indexing periodicals. For the nuclear physicist the information carried in an abstracting periodical is out-dated because of the time lag between the publication of a paper and the appearance of its abstract in a secondary periodical.

3 Bibliographies on specific subjects are compiled by such agencies as the International Atomic Energy Agency (Vienna) and other organisations connected with atomic energy work. The Library and Technical Information Section of BARC compiles bibliographies on request by scientists. These are widely used. Suggestions have been received for updating the bibliographies.

7 SUM UP

71 Use of Microform

Scientists are not much inclined to use documents in microform. For,

1 They are to be used in a particular place in the library where the reading machines are provided;

2 Copying down text, formulae, diagram etc in a closed dark room is not very pleasant; and

3 Continuous reading of microform projections for a length of time can be a strain.

These inconveniences can be minimised by providing good microform reading machines, and giving to the reader a full-size copy of the document using Xerox or other quick, cheap reprography method.

BARC provides such facilities to the scientists.

72 Knowledge about Library Service

The survey disclosed that several scientists were not aware of the different services provided by the BARC Library and Technical Information Section. An orientation course on the use of the library and its services, conducted either at the end of the training course at BARC or routinely once a year for the new trainees can, perhaps, improve the situation. This could be a part of the reference librarian's function.

73 Liaison

Provision of a documentalist in each research team would be helpful. He would maintain a liaison between the members of the research team on the one hand and the library services on the other. He would have intimate knowledge of the work being pursued by each of the members of the team and their respective information requirements. He would not only provide all the necessary documentation services to the team but also help to improve the existing services and develop new areas to meet new demands of readers.

74 International Nuclear Information System

A very commendable step has been taken by the International Atomic Energy Agency (Vienna) in providing a documentation service to the nuclear scientists the world over. The computer-based International Nuclear Information System (INIS)

collects information on research and development work done in the subject by the member states, and disseminates the information with a minimum of delay to the member states through the INIS Atomindex. Each member state sends to INIS information on current research work done by its scientists in nuclear science and technology and receives in return information about work done in other member states. BARC is the regional centre of INIS for India.

75 Other Noteworthy Points Resulting from this Survey

1 The metallurgist uses more varieties of documents than the nuclear physicist. For example, there is practically no citation to patents and standards by nuclear physicists.

2 The nuclear physicist places greater weightage on personal contact and communication with peers in the field.

3 Technical reports and proceedings of conferences are more frequently used by nuclear physicists than by metallurgists.

4 Books are more frequently used by metallurgists than by nuclear physicists.

5 Secondary sources, such as Current contents

appear to be extensively used by both groups of specialists to learn about the recent developments in their respective subjects of interest.

6 The metallurgist makes more extensive use of abstracting and indexing periodicals to collect information and data before starting work on a project.

8 ACKNOWLEDGEMENT

I am grateful to Dr V A Kamath for his encouragement and suggestions, in making the survey reported here. My thanks are also due to Mrs A Krishnan for her help and to Shri M G Bhide for his kind interest.

DRTC Seminar (9)(1971). Paper BE.

CITATION OF DOCUMENTS IN RADIO ENGINEERING: A CASE STUDY.

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[Comparative study of citations in the field of radio engineering in 1958-62 and 1970, in respect of the following: (1) Average number of citations per article in Proc IEE; (2) Distribution of citations by variety of host documents; (3) Frequency of citation of particular periodicals; (4) Distribution of citations by dominant subject of host periodical; and (5) Year of publication of the host periodicals cited in Proc IEE. The change in the pattern of citations during the twelve-year period 1958 to 1970 is commented upon].

0 INTRODUCTION

01 Scope of the Work

The objective of the work reported in this paper is to find out the pattern of use of documents by specialists in Radio Engineering. The method adopted is to analyse the bibliographical citations by radio engineers. The analysis also provides information on some other characteristics of the documents in the subject -- such as, scatter of the pertinent information in a variety of documents, seepage, and usefulness.

02 Definition

021 Scatter

"Scatter" denotes the publication of information on a subject in a variety of documents -- such as, book, article in periodical, thesis, technical report, and standard.

022 Seepage

"Seepage" denotes the publication of information on a subject in documents, particularly periodical publications, predominantly devoted to other subjects.

03 Procedure

Information on the bibliographical references given in articles published in Proc IEE (formerly Proc IRE) volume for 1970, was collected. The procedure adopted was similar to that used in a similar study done earlier (Gundu Rao (D). Scatter and seepage of documents on radio engineering. (In Ranganathan (S R) and Neelameghan (A), Ed. Documentation periodicals. 1963. Paper 3D)).

04 Data

The data collected has been analysed as follows:

1 Average number of citations per article in Proc IEE;

2 Distribution of citations by variety of host documents;

3 Frequency of citation of particular periodical (first twenty periodicals only);

4 Distribution of citations by dominant subject of host periodical; and

5 Year of publication of the host periodicals cited in Proc IEE.

In each table, similar data collected for the period 1958-62 are given for comparison. The data for 1958-62 has been taken from my earlier article referred to in Sec 03.

1 TABLE 1. AVERAGE NUMBER OF CITATIONS PER ARTICLE/LETTER IN PROC IRE

Total Number of				Average Number of Citations per Article/ Letter	
Articles and letters		Citations			
1970	1958-1962	1970	1958-1962	1970	1958-1962
509	2,391	4,467	6,088	8.8	2.2

11 Annotation

1 The ratio of the number of articles to the number of letters in 1970 was 1:2.5, whereas it was 1:1.7 in the period 1958-62.

2 The ratio of the average number of citations in an article to that in a letter was 6:1 in 1970, whereas it was 4:1 in the period 1958-62.

3 The average number of citations per article/letter in 1970 was four times that in 1958-62.

207

2 TABLE 2. VARIETY OF DOCUMENTS CITED

SN	Variety of Document	Citation			
		1970		1958-62	
		N	% of 4,467	N	% of 6,088
1	Article in periodical	3,091	69.2	5,050	83.0
2	Book	697	15.6	1,025	16.8
3	Conference proceedings	354	7.8	-	
4	Technical report ..	229	5.1	3	
5	Thesis	49		9	0.2
6	Patent	16		1	
7	Private communication	15		-	
8	Contract document..	11	2.3	-	
9	Lecture	3		-	
10	Standard	1		-	
11	Unclassified memo	1		-	
		4,467		6,088	

21 Annotation

1 The average number of citations per volume during the period 1958-62 was about 1,020. This has increased by more than four times in 1970.

2 For 1958-62, the data on conference proceedings was added to those for articles in periodicals. Even if a similar thing is done for the data for 1970, the citations are scattered in more variety of documents in 1970 than in 1958-62. The larger percentage of citations (5.1 per cent) to technical reports in 1970 is noteworthy.

3 The percentage of articles (including conference papers) referred to is about 5 per cent higher in 1958-62 than in 1970.

3 TABLE 3. FREQUENCY OF CITATIONS OF HOST PERIODICAL
(a) 1970. Arranged in the Decreasing Sequence of Frequency of Citation, 1-20.

SN	Title of Host Periodical	N of citations	Cumulative	
			Total	%
*1	IEEE transactions ..	641	641	21
*2	Proc IEEE	512	1,153	38
3	Appl phys letters (1962-)	251	1,404	46
*4	J appl phys	193	1,597	53
5	IEEE j quantum electron (1963-)	150	1,747	58
*6	J Opt Soc Amer ..	89	1,836	61
*7	Bell Syst tech j ..	83	1,919	64
8	Solid state electron (1965-)	62	1,981	66
9	Appl opt (1964-) ..	62	2,043	68
10	J Acous Soc Amer ..	57	2,100	70
11	Electro letters (1963-)	55	2,155	71
*12	Proc IEE	47	2,202	73
*13	RCA rev	21	2,223	74
14	Sov phys JEPT	20	2,243	75
15	IEEE spectrum (1964-)	20	2,263	75
16	Bul Amer Phys Soc ..	17	2,280	76
17	Control engin	17	2,297	76
18	Microwave j	16	2,313	77
*19	Nature	16	2,329	79
20	Science	14	2,343	79
21-264	Other periodicals (244)	698	3,091	100

209

(b) 1958-62. Arranged in the Decreasing Sequence of Frequency of Citation , 1 to 20.

SN	Title of Host Periodical	N of citations	Cumulative	
			Total	%
1	Proc Inst Radio Eng ..	2,504	2,504	46
2	Inst Radio Eng trans ..	450	2,954	59
3	J appl phys	393	3,347	66
4	Bell Sys tech j	293	3,640	72
5	Geophys res	120	3,760	74
6	RCA rev	105	3,865	77
7	J Optical Soc Am ..	103	3,968	79
8	Rev sci instrum	92	4,060	80
9	Phys rev lett	82	4,142	82
10	Phys rev	74	4,216	83
11	Electronics	58	4,274	85
12	Proc Inst Elect Eng ..	44	4,318	86
13	Aust j phys	35	4,353	86
14	J Electrochem Soc ..	34	4,387	87
15	J atmos terrest phys ..	32	4,419	88
16	Nature	30	4,449	88
17	Brit j appl phys ..	28	4,477	89
18	Canad j phys	24	4,501	89
19	IBM j res & dev ..	24	4,525	90
20	Astrophys j	22	4,547	90
21-101	Other periodicals (81) ..	503	5,050	100

31 Annotation

1 The periodicals in the first twenty ranks covered 90 per cent of the total number of citations during 1958-62, whereas the first twenty periodicals covered only 80 per cent of the total number of citations in 1970.

210

2 There is considerable difference in the ranking of periodicals in respect of frequency of citations. In 1958-62, Proc IRE had 46 per cent of the total number of citations and occupied the first rank. In 1970, Proc IEEE had only 19 per cent of the total number of citations and occupied the second rank. In 1958-62, IRE transactions had occupied the second rank. In 1970, IEEE transactions had 21 per cent of the total number of citations and occupied the first rank.

3 Out of the 20 periodicals coming in the first 20 ranks in 1958-62, only 8 have come into the first 20 ranks in 1970. Each of these is marked with an asterisk in Table 3(a) for 1970. Out of the 20 periodicals in Table 3(a), six periodicals were those started publication in 1962 or after that year. These six periodicals will naturally be not found in Table 3 (b) for 1958-62. The total number of citations in these periodicals is 600 -- 19.5 per cent -- of the total number of citations in 1970.

4 The 3,091 citations in 1970 were scattered in 264 periodicals, whereas the 5,050 citations in 1958-62 were scattered in only 101 periodicals.

4 SEEPAGE

Table 4 presents data on the distribution of the articles cited by the dominant subject of specialisation of the host periodical. This would give some idea of the extent of seepage of documents in radio engineering in 1970 and in 1958-62.

41 Table 4. Distribution of Citations by Dominent Subject of Host Periodical

Dominant subject of the periodical cited		N of documents cited		% of total	
Colon (CN)	Name	1970	1958-62	1970	1958-62
(a)	(b)	(c)	(d)	(e)	(f)
8	Management science	2	-	0.1	-
9d	Standardisation	3	-	0.1	-
9B	Computer science	23	43	0.7	0.9
9C	Instrumentation and Control	31	115	1.0	2.3
9P	Communication theory	11	2	0.3	..
A	Natural sciences	61	93	2.0	1.8
AF	Ocean sciences	4	-	0.1	-
AG	Space sciences	11	-	0.3	-
AP	Surface science	4	-	0.1	-
B	Mathematics	76	5	2.5	0.1
B7	Mechanics	2	-	0.1	-
B8	Mathematical physics	2	3	0.1	0.06
BTT	Operations research	1	-	-	-
BV	Cybernetics	4	-	0.1	-
BX	Astronomy	1	-	-	-
BXT	Astrophysics	1	27	-	0.5
C	Physics	927	887	30.0	17.6
D	Engineering	17	3	0.6	0.06
D6,5	Electronic eng	1,732	3,553	56.0	70.4
D6,6	Electrical eng	27	96	0.9	1.9
D6,7	Nuclear eng	5	-	0.2	-
D8	Commodity prod eng	11	-	-	-
E	Chemistry	10	55	0.4	1.1
EX	Chemical eng	17	-	0.6	-
F	Commodity prod tech	31	2	1.0	-
G	Biology	6	4	0.2	0.08
GWC	Biophysics	9	-	0.3	-
H	Geology	2	-	0.1	-
HV	Geophysics	11	152	0.3	3.0
HV81	Meteorology	1	9	-	0.2
HX	Mining	16	-	0.5	-
L	Medicine	21	-	0.7	-
LU6	Hospital	1	-	-	-
LUD	Medical technology	2	-	0.1	-
M95	Photography	1	1	-	-
S	Psychology	10	-	0.4	-
W	Political science	1	-	-	-
X	Economics	5	-	0.2	-
Z	Law	1	-	-	-
	Total ..	3,091	5,050	100.00	100.0

212

411 Annotation

1 Commenting on the data presented in Table 3 in Sec 31, it was mentioned that since 1962 several new periodicals have come up and carry articles on radio engineering. This is confirmed by the data presented in Table 4, which shows a greater extent of seepage in 1970 than that in 1958-62. The seepage of articles, though a small percentage, into periodicals in the Biological sciences, Medical sciences, Psychology and Social sciences -- such as Political science, Economics, and Law -- in 1970, may be noted.

2 Periodicals in Electronic Engineering continue to carry the bulk of the articles. But the percentage has dropped from 70 in 1958-62 to 56 in 1970.

3 On the other hand, the percentage of articles, in periodicals in Physics has shown a marked increase, from about 18 per cent in 1958-62 to 30 per cent in 1970.

4 In both the periods, about 87 per cent of the articles is carried by periodicals in electronic engineering and physics taken together. The total number of periodicals in electronic engineering and physics carrying this percentage of articles were 101 and 55 in 1970 and 1958-62 respectively,

5 The comparatively higher percentage of citations to periodicals in Astrophysics and Geophysics in 1958-62 is worth noting.

5 CITATIONS OF EARLIER PUBLICATIONS

Table 5 presents data on the distribution of articles by the year of publication of the host periodicals. The data for 1958-62 are the average for each of the years taken from Table 4 in my earlier article mentioned in Sec 03.

213

51 Table 5. Year of Publication of Document Cited

Year of document cited	N of documents cited in 1970*	Average N of documents cited in 1958-62**
a	b	c
1970	324	-
1969	883	-
1968	642	-
1967	579	-
1966	396	-
1965	362	-
1964	227	-
1963	177	-
1962	140	119
1961	98	215
1960	116	183
1959	70	159
1958	72	115
1957	46	113
1956	52	89
1955	22	77
1954	30	57
1953	27	39
1952	15	36
1951	30	14
1950	20	14
1949	11	20
1948	19	12
1947	43	11
1946	12	8
1945	10	6
1944	-	5
1943	-	3
1942	-	2
1941	-	3
1940	-	3
1939	-	4
1938	-	3
1937	-	3
1936	-	4
1935	-	3
1934	-	2
1933	-	4
1932	-	2
1931	-	1

*Comparatively very few documents published earlier to 1945 were cited in 1970. The total number of such documents was 36 over a 60-year period. Hence these data are not given in the table.

**Comparatively very few documents published earlier to 1931 were cited in the documents of 1958-62. Hence these data are not given in the table.

51 Annotation

1 In Paper BJ by I K Ravichandra Rao in this volume, the above data have been used to study the utility factor, obsolescence factor, ageing factor, etc of periodicals. It is shown that the value of the average ageing factor is smaller for the more recent documents as compared to that for documents ten to twelve years older. Therefore, the utility factor has a lower value for the older documents than for the more recent ones.

6 CONCLUSION

1 The reports on research in radio engineering are scattered in more varieties of documents in 1970 than in 1958-62.

2 A larger number (264) of periodicals carry articles on radio engineering in 1970 as compared to that (101) in 1958-62.

3 The seepage is greater in 1970.

4 The pattern of ranking of periodicals according to frequency of citation has changed to an appreciable extent during the twelve-year period 1958-62 to 1970.

215

5 The value of the average ageing factor and of utility factor of articles on radio engineering has also changed over the 12-year period 1958-62 to 1970.

7 ACKNOWLEDGMENT

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DRTC Seminar (9)(1971). Paper BF.

CITATION OF DOCUMENTS BY SPECIALISTS: A CASE STUDY.

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[The documents cited in ninety-two technical reports by the scientists of the National Aeronautical Laboratory, Bangalore, have been analysed. The factors considered include: (1) Variety of documents cited; (2) Average number of documents cited per report; (3) Distribution of citations by year of the document cited; (4) Distribution of the documents cited by language; (5) Distribution of the technical reports cited by country of origin and by sponsor; (6) Ranking of some periodicals by frequency of citation; (7) Self-citation; (8) Repeated citation; and (9) Structure of the citation. Some of the data are compared with the findings reported from libraries serving similar group of subject specialists_7.

0 INTRODUCTION

01 Use of Citation Analysis

An article in a periodical, or any other kind of document, has either an immediate or a retrospective "reader impact". The reader may cite it in his writing. Therefore, a study of the documents cited by specialists in a subject can provide some information on

1. The pattern of use of different varieties of documents by the specialists in that field; and

2 The rating of different documents in the subject by specialists.

Thus, citation analysis is a well established and widely used technique to gather information of the above-mentioned type and for other purposes (2,3,6,8).

02 Scope of the Paper

With a view to gaining a knowledge of the use of different varieties of documents by the scientists of the National Aeronautical Laboratory, Bangalore (=NAL), the documents cited in the ninety-two technical reports prepared by them during the period 1960-70, have been studied, using the conventional citation analysis procedure. The ninety-two reports consisted of Technical Notes, Technical Memorandum, Progress reports, and Scientific reviews. The study also provided some information about the documents cited. The implication of the findings to document service in NAL is considered.

03 Factors Studied

The analysis of the citations has been done in relation to the following factors:

1 Variety of documents cited;

2 Average number of documents cited per report;

3 Distribution of citations by year of the document cited;

4 Distribution of documents cited by language;

5 Distribution of technical reports cited by country of origin and by sponsor;

6 Ranking of periodicals by frequency of citation;

7 Self-citation; and

8 Frequency of citation to one and the same docu-

ment (Repeated citation).

The analysed data has been compared with the findings of earlier similar studies, wherever possible.

1 VARIETY OF DOCUMENTS CITED

11 Major Variety

Table 1 in Sec 111 presents data on the distribution of the citations by the major varieties of documents.

111 Table 1. Major Varieties of Documents

SN	Variety of Document	Number	% of 723
1	Technical report	311	43.0
2	Article in periodical ..	177	24.5
3	Book	128	17.7
4	Other	107	14.8
	Total	723	100.0

12 Other Variety

Table 2 in Sec 121 presents data on the distribution of the "107 other citations" by varieties of documents.

121 Table 2. Other Varieties of Documents

SN	Variety of Document	N	% of 107
1	Reference document	18	16.8
2	Special publication	17	15.9
3	Conference proceedings	15	14.0
4	Trade document	15	14.0
5	Standard	12	11.2
6	Thesis	10	9.4
7	Specification	9	8.4
8	Translation	6	5.6
9	Reprint	3	2.8
10	Private communication	1	0.9
11	Unpublished information.. ..	1	0.9
	Total	107	100.0

219

13 Comparison with Earlier Studies

Table 3 in Sec 131 presents data from earlier studies about the variety of documents used in different subject fields, for comparison with the findings of the present study.

131 Table 3. Comparative Data

SN	Study/Subject	Percentage of			
		Tech rep	Article	Book	Trade doc
1	Thorne/Aerodynamics (7)	44.0	31.0	13.0	..
2	Shaw/Science (4)	14.0	68.0	7.0	..
3	Cole/Petroleum tech (1)	18.0	58.0	35.0	5.0
4	NAL/Aerodynamics etc	43.0	24.5	17.7	14.0

14 Annotation

1 The technical report is the most extensively cited variety of document.

2 There appears to be a difference in the pattern of use of different varieties of documents in different subjects (Table 3). The findings of the present study are similar to those of Thorne's on the reading habits of scientists and technical staff at the Library of the Royal Aircraft Establishment. Earlier, Wilson had also reported similar data for the same institution (9). The pattern of use of documents by scientists in general (Shaw) and by Petroleum technologists (Cole) is quite different from that for the specialists in aerodynamics and related subjects.

2 AVERAGE NUMBER OF CITATIONS

Table 4 in Sec 21 presents data on the average number of citations per NAL technical reports distributed by the variety of documents cited.

21 Table 4. Average N of Citations per Report

SN	Type of Document Cited	N	Average
1	Technical report	311	3.1
2	Article in periodical ..	177	2.0
3	Book	128	1.4
4	Other	107	1.2
	Total	723	7.9

3 DISTRIBUTION OF CITATIONS BY YEAR OF HOST DOCUMENT

Table 5 in Sec 31 presents data on the percentage of technical reports and articles in periodicals falling in the 5-year, 10-year, and 15-year period immediately preceding the year of publication of the citing document.

Table 6 in Sec 32 gives summarised comparative data for technical reports and articles, derived on the basis of the data in Table 4.

31 Table 5. Distribution by Age of Cited Document

P = Periodical T = Technical Report

Citing tech rep			Cited Document					
				Cumulative % for the Preceding Years				
Year	N	Type	N	0-4 (5y)	0-9 (10y)	0-14 (15y)	0-19 (20y)	% beyond 20 years
1970	5	T	10	30.0	50.0	70.0	90.0	10.0
		P	5	20.0	60.0	80.0	100.0	0.0
1969	9	T	26	38.0	65.4	76.9	88.3	11.7
		P	23	38.7	47.3	73.1	90.3	9.7
1968	10	T	20	20.0	35.0	65.0	90.0	10.0
		P	10	10.0	70.0	90.0	90.0	10.0
1967	9	T	20	90.0	95.0	100.0	-	0.0
		P	56	43.2	81.0	91.8	95.4	4.6
1966	23	T	55	32.7	52.2	73.8	93.6	6.4
		P	31	32.3	61.5	77.7	92.8	7.2

Continued

Citing tech rep				Cited Document				
Year	N	Type	N	Cumulative % for the Preceding Years				% beyond 20 years
				0-4 (5y)	0-9 (10y)	0-14 (15y)	0-19 (20y)	
1965	8	T	25	28.0	68.0	92.0	96.0	4.0
		P	7	28.6	42.9	85.8	85.8	14.2
1964	9	T	15	20.0	33.3	79.8	100.0	0.0
		P	10	10.0	30.0	90.0	90.0	10.0
1963	12	T	59	59.5	88.4	93.5	100.0	0.0
		P	11	18.2	27.3	72.8	100.0	0.0
1962	4	T	4	75.0	100.0			
		P	2	0.0	50.0	100.0		
1961	20	T	38	50.0	76.3	94.7	100.0	0.0
		P	20	49.5	76.5	85.5	90.0	10.0

32 Table 6. Summarised Comparative Data

Preceding period	N of years	Percentage of citations to		
		Tech rep	Article in periodical	Tech rep+ Article
0-4	5	44.3	25.0	34.7
0-9	10	66.3	54.7	61.0
0-14	15	82.9	84.7	83.7

33 Annotation

1 There is no discernible pattern in the citation over the period 1961 to 1970.

2 About 60 per cent of the citations is to documents of the immediately preceding 10 years.

3 The percentage of technical reports cited for the immediately preceding 5-years is significantly higher than that for the articles in periodicals -- 44 per cent as compared to 25 per cent.

4 The margin of difference in the percentage between technical reports and articles in periodicals drops by about 50 per cent in the second 5-year period (that is, within the immediately preceding 10-year period). In the 15-year period, there is practically little difference in the percentage of citations between the two varieties of documents.

4 DISTRIBUTION OF CITATIONS BY LANGUAGE

Table 6 in Sec 41 presents data on the distribution by language of the documents cited.

41 Table 7. Language-wise Distribution

SN	Document	German		French		English	
		N	%	N	%	N	%
1	Technical report	12	3.8	3	1.1	296	95.2
2	Article ..	6	3.4	2	1.0	169	95.6
3	Book	6	4.6	-	.-	122	95.4
4	Other	3	2.8	-	-	104	97.2

42 Annotation

1 The percentage of the documents cited in languages other than English is negligible.

2 A majority of the citations to documents in German are in reports by specialists in propulsion. One of the authors of these multiple-authored reports had a knowledge of German. He has cited twice his thesis written in German.

3 The citation to documents in French are in the report by a Paris-trained French-knowing NAL scientist..

4 The data appear to indicate that, either the number of documents in languages other than the three mentioned above, is negligible in the subjects of the reports from NAL, or the scientist-authors of NAL have had no facility of learning about and using documents in other languages. However, there is now a full-fledged Translation Unit in NAL Library. This has helped the increased use of documents in Russian and other languages. This unit is also helping to publish regularly English abstracts to selected foreign language documents.

225

5 CITATION TO TECHNICAL REPORTS

.51 Distribution by Country of Origin

Table 7 in Sec 511 presents data on the distribution of the technical reports cited by the country of their origin. Out of the 311 reports cited, the country of origin could not be correctly identified for 16 reports.

511 Table 8. Distribution of Technical Reports by Country of Origin

SN	Country of Origin	N	% of 285
1	USA	126	44.2
2	India	69	24.2
3	UK	50	17.6
4	Canada	20	7.0
5	West Germany	9	3.2
6	France	5	1.8
7	Netherlands	3	1.1
8	Sweden	1	0.3
9	Australia	1	0.3
10	Japan	1	0.3
	Total ..	285	100.0

512 Annotation

1 Over 60 per cent of the technical reports cited have come from USA and UK. Wilson (9) also has reported similar findings in the case of RAE scientists.

2 Citation to Russian technical reports is conspicuous by its absence. Difficulty of access to the original Russian reports and the language barrier may be two reasons for this. The language problem is now being slowly got over by the Translation Unit of NAL.

3 It is noteworthy that the percentage of citations to Indian technical reports is a little over half that to US technical reports and occupies the second rank.

52 Distribution by Sponsor

Table 9 in Sec 521 presents data on the distribution of the US, Indian, and UK technical reports by the sponsoring body.

521 Table 9. Sponsor-wise Distribution

SN	Country/Sponsor	N	%
1	USA	126	
	USA/NACA ..	57	45.2
	NASA ..	21	16.7
	Other ..	48	38.1
2	INDIA	69	
	INDIA/NAL ..	65	94.2
	Other ..	4	5.8
3	UK	50	
	UK/ARC ..	41	82.0
	Other ..	9	18.0

522 Annotation

1 The NACA and NASA reports account for over 60 per cent of the US technical reports cited.

2 The predominance of citations to NAL technical reports among the Indian technical reports may be due to the fact that other scientists in India are not covering the same field in which NAL scientists are working.

6 FREQUENCY OF CITATION

61 Periodicals

Table 10 in Sec 611 presents data on the first four most cited periodicals.

611 Table 10. Ranking of Periodicals

Rank	Periodical	Number of Citations
1	J aeronaut sci (1934-58) contd as J of aerospace sc (1958-60)(USA)	28
2	AIAA journal (USA)	13
3	Jet propulsion (USA)	11
4	J fluid mech (UK)	9
	Total ..	61

612 Annotation

1 Wilson (9) has mentioned that the J aeron sci and J fluid mech are among the more useful periodicals to specialists in aerodynamics. The data presented above conform to his findings. However, J fluid mech ranked fourth in this study, is in the ninth position in Simosko and Smiths' recent study (5).

2 American periodicals predominate the citations.

62 Self-Citation

There were self-citations only in the case of technical reports. Eighteen reports gave rise to 23 self-citations, made up of 20 technical reports and 3 theses. Self-citation may be due to one or

more of the following reasons:

1 One or more of the authors of the citing document and cited document may be the same;

2 These authors might have continued the work reported in the self-citation; and

3 In a few cases, the document representing self-citation, has provided the background information.

7 STRUCTURE OF CITATION

The form of bibliographical citation, given in the reports examined, has not been completely satisfactory. Some of the deficiencies noted in several of the citations are as follows:

SN	Citation to	Deficiency
1	Technical report ..	Omission of date of publication.
2	Article in periodical	Omission of the number of the issue when the pagination in the periodical is not continuous.
		Omission of the date of publication.
		Use of different abbreviations for the title of one and the same periodical.
		Variation in the abbreviations for one and the same word or word-group.
		Variation in the sequence of the items of information given in different citations.
3	Book	Omission of the edition statement.
		Omission of date of publication.

SN	Citation to	Deficiency
4	Proceedings of conference	Omission of the place of conference. Omission of the date of conference .

It is essential that a standard practice, such as that prescribed by the Indian Standards Institution, is used consistently in citing documents.

8 SUMMARY

1 NAL scientists use a variety of documents as sources of information.

2 Technical reports constitute the major source of information. Articles in periodicals are the most used source.

3 Technical reports generated by NAL scientists are frequently used, second only to those from USA.

4 The percentage of citations to more recent technical reports is higher than that for articles in periodicals.

5 There are very few citations to documents other than in English.

6 More than 30 per cent of the articles cited are from four periodicals.

7 The form and structure of the citations should be according to an acceptable standard.

91 ACKNOWLEDGMENT

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4 Sec 131 SHAW (h R). Pilot study on the use of scientific literature by scientists. Washington. 1956. (Quoted in Ref 8).

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DRTC Seminar (9)(1971). Paper BG.

USE OF INFORMATION BY BIOLOGISTS: A CASE STUDY.

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/There is need for surveying the use of information by scientists. As a case study, a survey by questionnaire and interview of a hundred biologists in regard to the variety of information required and their attitude to documentation service, was carried out. The findings of the survey are summarised and commented upon/.

1 OBJECTIVE OF DOCUMENTATION

The objective of documentation service is to minimise wastage of research potential due to unintended and unnecessary duplication of effort. It also brings to the notice of the research worker ideas which may guide and help him in his work and, at times, trigger new ideas and new lines of work.

2 NEED TO SURVEY USE OF DOCUMENTS BY SPECIALISTS

To be effective, the documentation service should enable each research worker to receive information on the subjects of his interest pinpointedly, exhaustively, expeditiously, and economically. In order to design and develop an efficient documentation system in a library it is necessary to know about the variety of information required and the pattern of use of information by the specialists using the library.

3 METHOD OF SURVEY

31 Questionnaire and Interview

As a case study, the questionnaire method followed up by an interview, was used to survey the variety of information required by and attitude to documentation service of, one hundred biologists working in the Central Marine Fisheries Research Institute (= CMFRI), its subordinate establishments, and the Salt Research Station at Mandapam, Tamil Nadu.

4 QUESTIONNAIRE

41 Questions

The following questions were included in the questionnaire:

1 What type of knowledge -- qualitative or quantitative -- you largely require in your research work?

2 Is the recorded information given in documents adequate to acquire a thorough knowledge in your research work?

3 At what stage of your research work you require relatively more information?

4 Which is the most useful variety of document in relation to the different aspects of your research project (Book, article in periodical, patent, specification, standard, picture, photograph, etc)?

5 Are you satisfied with the documents available in the library you normally use?

6 Do you agree that the present sources and methods of acquiring scientific information are adequate?

7 Do you require "telegraphic information" for quicker dissemination of information?

42 REPLIES TO QUESTIONS

421 Question 1

Seventy-five per cent of the scientists reported that they mainly require qualitative information. A few scientists reported that they require quantitative information, while ten scientists said that both qualitative and quantitative information was necessary. Later, in the course of the interview, when the question was put to the scientists, they said that qualitative information is usually required at the initial stages of the work for use as guidelines, and quantitative information is required at the later stages of the work, when data would have been collected from experimental observation.

422 Question 2

All the scientists reported that the recorded information available from documents was adequate for their work.

423 Question 3

About sixty per cent of the scientists reported that they require more information in the initial stages of the work. This may cover the research already done in the specific field of their interest, methods of experimentation, equipment to be used, techniques that may be helpful in analysing data, etc.

424 Questions 4 and 5

Twenty scientists of CMFRI reported satisfaction with the document resources and the services provided by

the library; four scientists of the CMFRI subordinate establishments and the scientists at the Salt Research Station expressed dissatisfaction with the ayailable library resources and reference service.

425 Question 6

Almost all the scientists reported satisfaction with the method presently used for acquisition of information.

326 Question 7

Most of the scientists did not appreciate the idea of "telegraphic information".

5 INTERVIEW

51 Questions

The survey by questionnaire was followed up by an interview of 90 scientists of the various institutions mentioned above. In addition to discussing some of the questions mentioned in the questionnaire (See Sec 41) personally, the following additional points were discussed in the interview:

1 Do you agree that documentation service is a safeguard against wastage of time and effort on your part by preventing needless repetition of work?

2 Does the indexing of scientific papers save your time in searching for information?

3 Do the abstracting periodicals help you in locating the documents embodying the subject of your interest?

4 Has documentation service helped you in your collection of bibliographical references or in promoting contact with other scientists in your own field or a similar

field of work.

5 The work of a scientist very much depends on the acquisition of information on the subject of his research. A library has limited facility to acquire all the documents that may be needed by its readers. In this context, documentation service is of considerable importance. What is your view?

52 Summary of Scientists' Views

1 Most of the scientists are in agreement about the important role of documentation service in research work. They agree that it saves them time and minimises chances of unintended and unnecessary duplication of work.

When a scientist starts on a research project, he would like to know about the state-of-art and trends in the field. Documentation service is of particular value in this respect.

2 Some of the scientists, particularly those in the smaller establishments, mentioned problems of getting up-to-date information in their respective fields of interest.

3 A few scientists have had to stop work for some days -- say, one or two weeks -- for want of information, to proceed further.

4 There was a general appreciation of the usefulness of abstracting services in giving some idea ofthe work which may otherwise be not known to a scientist, because of the language barrier, or publication of work in a variety of documents and in periodicals devoted primarily to other subjects, etc.

5 In addition to helping to conserve research potential, documentation also helps to establish contacts between scientists working in similar subjects in different parts of the world -- through correspondence, exchange of reprints, etc.

6 CONCLUSION

The survey reported in this article, though limited in its scope and sophistication, indicates that research workers in biology do appreciate the value of documentation service in saving time and effort, by minimising unnecessary duplication of work, in triggering new ideas, in providing guidelines for research, and in promoting useful contacts among scientists in different parts of the world.

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DRTC Seminar (9)(1971). Paper BH.

KINDS OF IMPACT OF INFORMATION ON POSTGRADUATE RESEARCH: CASE STUDIES.

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/Thirty two persons engaged in post-graduate research leading to the doctoral degree in a research-cum-academic institution were interviewed to find out if there had been any change in their research work on the basis of information gathered from published documents or from discussion with colleagues etc. Fourteen of the research workers reported one kind of impact or other of published documents on their research program. A summary of the narration of the events by each of these research workers is presented in the form offourteen case studies. Aid in the selection of a specific subject for research, clarification of ideas and guidance in work, support for the line of approach adopted, unintended duplication of a part or whole of the work and consequent minor or major changes in the research work, are the different kinds of use and impact of published documents. The crucial event has occurred in a majority of the cases within the third year after the starting of the research work. Suggests similar but more elaborate studies among a larger number of doctoral candidates to facilitate the inference ofsome patterns of use of information by such persons. The implication of the findings to library service is mentioned/.

1 SCOPE OF THE PAPER

In paper BA in this volume extracts from 30

published case histories have been presented to illustrate the use of information by research workers, inventors, and innovators. In paper BC, also in this volume, case studies to illustrate the pattern of use and search for documents by scientists in an academic-cum-research type institution have been presented. In the present paper case studies are presented to illustrate the impact of information on

1 Research work leading to doctoral degree; and

2 The pattern of use of the information by research students.

It was felt that the pattern of use and impact of information on research leading to a degree may be different from that in the case of scientists who have already completed the student career. A course of studies and research leading to a doctoral degree has integrated within it, the research scholar gaining knowledge about the

1 Relevant documents in the field;

2 Methods of locating such documents through the use of library and the tools useful in document searching -- such as, abstracting, indexing, and reviewing periodicals;

3 Specialists in the subject; and

4 Institutions where similar work is carried out.

Such knowledge would help the research student to achieve productivity in his later research career. Invariably, in the course of his studies, the research scholar has to make use of published documents at the different stages of his research work,

in addition to being guided by his supervisor or senior colleagues.

2 PROCEDURE

21 Questionnaire/Interview

To start with, a questionnaire was prepared for the purpose of circulating it among the research scholars. A specimen of the questionnaire is given in Appendix 1. However, when the questionnaire was given to some ten research scholars, the response was not satisfactory. In some cases, some of the questions were not clear to the research scholar. In a few other cases the scholar was not willing to give details of his work for one reason or the other. Therefore, the personal interview method was adopted. The purpose of the sruvey was explained and on the basis of a planned dialogue using the questionnaire, information was elicited. The following additional questions were used in the interview, largely as clarification points:

Nature of help and modification arising from published documents:

1 Specification and selection of subject of research.
2 Clarification of ideas, guidance in the methodology, reorientation of approach.
3 Substantiation and support of the work in progress.
4 Unintended duplication of work.
5 Modification of work in progress, if any, and the nature of the modification.

In all, 32 research students in an academic-cum-research type institution were interviewed and their narration recorded.

3 SOME CHARACTERISTICS OF THE POPULATION SURVEYED

31 Completion of Programme

Some of the research scholars have already completed the doctoral programme while others are yet to complete it, but have been working on the project for about a year. Table 1 gives data about the stage of the project when the scholars were interviewed.

311 Table 1. Stage of Project

SN	Particulars	Number
1	Completed doctoral programme	9
2	Research in progress	23
		32

32 Status of Research Scholar

Table 2 presents data about the academic status of the research scholars.

321 Table 2. Academic Status of Research Scholar

SN	Designation	Number	
		Ph D completed	Research in progress
1	Lecturer	5	2
2	Associate Professor	-	1
3	Senior Research Assistant	3	3
4	Research Fellow	-	2
5	Research Student	1	15
		9	23
			241

33 Field of Specialisation

Table 3 in Sec 331 presents data on the subject of specialisation of the research workers interviewed.

331 Table 3. Subject of Specialisation

SN	Subject		N of research workers
	Colon Cl N	Name	
1	8	Management science	2
2	9C	Instrumentation	2
3	B	Mathematics	1
4	C	Physics	1
5	D	Engineering: Mechanical, Power, Electrical Aeronautical	5
6	E	Chemistry: Inorganic and Physical, Organic	12
7	EX	Chemical engineering	6
8	GX	Biochemistry	2
9	LX	Pharmacology	1
		Total	32

4 ANALYSIS OF RESPONSES

41 Two Categories

Since the objective of this survey has been to find out whether the information gathered by research scholars from documents or from other sources has had any significant impact on the research work in progress at some stage or other, the responses received were first grouped into the following two categories:

1 Cases in which some change in the research programme was necessary; and

2 Cases in which there was no change in the research programme.

Table 4 in Sec 411 presents data regarding the occurrence of change in research work.

242

411 Table 4. Cases of Change in Research Programme

SN	Particulars		N	% of 32
1	No modification		11	34.4
2	Involved modification		21	65.6
	21 On the basis of information gathered from published documents;	15		
	22 For other reasons*	6		
		Total	32	100.0

*The "other reasons" mentioned under 22 include such factors as non-availability of required equipment, change of guide, ill-health and marriage.

Only the 15 cases which involved some modification in the research programme caused by the information gathered from published documents or discussion with colleagues and guide are further considered in this paper. For one case, the full narration was not available.

5 SUMMARY OF FINDINGS

51 Variety of Use of Information

In Sec 6 a summary of each of the 14 cases is presented as it was recorded during the narration of the case by the research scholar at the time of the interview with him. A perusal of these cases indicates that there have been different uses of the information gathered from published documents. Briefly they are:

1 Help in the specification of the Subject of

research. For example, by surveying the documents in a particular field, a fallow region suitable for investigation may be sensed. Or, a redifinition or a more exact specification of the subject with which the research was begun.

2 Clarification and guidance. For example, some of the ideas in the subject of the project may get clarified and some helpful guidelines, such as, that about the methodology, may be available.

3 Substantiation and support. For example, in some cases when the research scholar locates a similar kind of work, he may feel greater confidence in the line of approach he adopts in his research.

4 Duplication. For example, several research workers in different parts of the world may be working on the same problem and even proceeding on similar lines, but not aware of each other's work. Some papers may be generated from some of these projects and this may lead to either a partial or a full duplication (though unintended) of the work of others.

5 Modification. For example, the modification in respect of methodology or some facet of the subject under investigation or even complete change of the subject.

Table 5 summarises the incidence of the different kinds of impact in the case studies presented in Sec 6.

52 Table 5. Chart of Incidence of Impact

Case	Selection/ Specification	Clarification/Guidance	Substantiation/ Support	Unintended duplication	Modification
1		x	x	x	x
2		x	x		
3	x	x			x
4					x
5		x			
6	x	x	x	x	
7				x	
8	x	x		x	x
9				x	x
10				x	x
11	x	x			
12				x	x
13				x	x
14	x			x	x
15	x	x		x	
	6	8	3	10	8

53 Time of Impact

Table 6 presents data on the time lapse after the start of the project when the impact occurred.

531 Table 6. Stage of Research when Impact Occurred

SN	Particulars	N	%
1	Upto and including 1 year	6	40.0
2	After 1 year but before completion of 3 years	5	33.3
3	After completion of 3 years	4	26.7
	Total	15	100.0

245

532 Annotation

1 In nearly 75 per cent of the cases the impact occurred within 3 years of starting the project. The average period for completion of research is 5 years.

2 Out of the 10 projects which required modification in work, 6 cases required modification within about a year of starting the work.

3 In one case, duplication of work was noticed within 6 months of starting of the project; at the other extreme, in one case the duplication was noticed about 6 months after submission of the thesis.

6 CASE STUDIES

The following case studies are grouped and arranged broadly by the subject of research. Each case study mentions the subject of research and gives a summary of the narration as given by the research worker:

CASE 1

1 Subject of Research

Fibre reinforced composite materials, with special reference to the design of joints in space vehicles.

2 Summary of Narration

I was working on the subject from 1963-67. While making a survey of the documents likely to provide information on the subject, the experimental work which was published in the British journal of applied physics (1963-67) gave me confidence that I was

proceeding on the right lines.

Subsequently, while looking up some documents in the Library of the National Aeronautical Laboratory, Bangalore, I came across C S Chang's thesis covering my subject. A paper based on this thesis was published in the International journal of mechanical science (1970 Sep). In the first instance, I was somewhat shocked for, I thought that my work would have to be abandoned as it is likely to be a duplication. However, after reading through the thesis and the paper thoroughly, I found that the methodology adopted by me was different, though the result might be the same.

Some time later, I came across another article "Planer elasticity as potential theory" by Rufus Issacs published in the Mathem y Fis theor (1948). This article threw much light on the subject of my investigation.

In summary, I would say that the information I could gather from documents

1 Supported my present work;

2 Clarified several of the ideas I have used;

3 Gave ideas on methodology for the experimental work;

4 Helped to add some additional data;

5 Led to the remeasurement of some variables; and

6 Necessitated some change in the general form and organisation of the text of my thesis.

BH6 Raghavendra Rao

CASE 2

1 Subject of Research

Spectrochemical study of passivation.

2 Summary of Narration

In the course of my studies on passivation since 1970, a particular problem I was concerned recently was the preparation of metal coated electrodes. Some difficulties were faced in using the usual vacuum deposition technique described in books. For about a month, I went on changing the variables in the process. At that stage I came across an article on glass coated electrodes by a specialist in the subject:

KUWANA (T). Preparation of conducting glass electrodes. (Anal chem. 1970 Oct).

Several articles had been published by him on this subject. I wrote to Dr Kuwana, at the Case-Western Reserve University, for details of the preparation of the electrode. He sent me a reprint of an article which contained the details.

I tried to prepare the electrode as described in the paper. But I got different results. I could not find any explanation for it. However, the work has given me confidence in my approach to the problem, and improvements may be brought about on the basis of experience.

CASE 3

1 Subject of Research

Basic equations for transport processes for laminar

flow through helically and spirally coiled tubes.

2 Summary of Narration

I have been investigating of the subject since 1967. I thought that the equation for laminar flow through helically and spirally coiled tubes would be significantly different from the equation for flow through a tube in theform of an arc of a circle. After a great deal of struggle with the problem, I came across the paper:"The stream-line motion of fluid in a curved pipe", published in the Philosophical magazine and journal of science of 1928, by W R Dean. This helped me to formulate my problem in a mathematical form and adopt a proper line of approach. I could then derive the necessary equations using books on basic vector theory. Later it was found that the equations were just a modification of Prof Dean's equation but with a few more terms. The modified equation gives a definite qualitative and quantitative idea of the transport process for flow not only through helically and spirally coiled tubes, but in general,for any curve. the path of which is followed by the tube.

CASE 4

1 Subject of Research

Theoretical investigations on the flow of fluids with special reference to quantum liquids.

2 Summary of Narration.

About the end of Jan 1966, a year or so after I started work on the project, I came across a

paper in which experimental data from a study similar to that of mine was reported. However, the data did not tally with the results derived from the theoretical calculations made by me. This disagreement could not be explained in spite of our several attempts to do so. Therefore, my project was changed to "Some theoretical investigations on the flow of fluids with special reference to emulsions". This was completed in 1968.

However, we did examine again later the reported experimental results, and found that they were not completely correct and the problem remained unsolved.

CASE 5

1 Subject of Research

Purification of waste water by biological processes.

2 Summary of Narration

I had this subject in mind even when I was in the USA in 1965. I had made an extensive survey of some 2,500 papers, but I could find only about a dozen of them dealing with the fundamental aspect of the problem. This study of documents went on for a year, but even then I could not precisely define my subject of research.

In the second year, I returned to India and continued to work on the project. The papers by Gotalls and Oswald and by Caldwell published in Sewage and industrial water 1949-50 and 1946 respectively, were very useful. I could now redefine my subject as: "Purification of waste water by biological processes with special reference to oxidation pond".

Quite a significant change in my project arose in 1970. I was invited to deliver a lecture on the subject of my investigation at the Institution of Engineers, Bangalore.

Prof ... was Chairman of that lecture. After my lecture, there was a great deal of fruitful discussion on the subject for about an hour. A discussion with Prof ... for another hour followed this. The work I was engaged on was thoroughly examined and the result was a change in my thinking and approach to the problem. The discussion gave me a proper perspective of the subject, helped to consider it in terms of universal phenomenon to redefine the problem, and add more relevant points to it. Earlier my experiments centred round the study of the general performance of the pond and its economics. Now I am concentrating on the fundamental principles, and laboratory experiments have been redisigned.

I should also mention here an instance of how an article helped me. One of the problems connected with my work is: "Use of C_{14} in the study of pH rise in the oxidation pond". After about six months of work we got stuck up. The expected result was not coming up. I searched Chemical abstracts and located an article in Nature (1968). This report gave me an idea of the correct methodology to be used and as how to standardise. With suitable modification of the method, I could successfully carry out the experiments.

CASE 6

1 Subject of Research

Corduneanu's and Popov's methods in time-varying system stability analysis.

2 Summary of Narration

I started work on the project in 1966. Between 1966 and 1968 I had not clearly formulated a project to work on; I was trying to specify a subject within the broader field "Control engineering: Controllability/Optimal control/Statility theory etc". The first project I took up was based on "Corduneanu's theorem".

About the beginning of 1969, I chanced to see the following article:

SRINATH (M D), THATHACHAR (M A L) and RAMA PRIYAM (H K). Stability of a class of non-linear time varying systems. (Intern j contr. 7;1968; 117-32).

The subject reported in this paper had a considerable impact on my work, namely, I could formulate the subject for my thesis precisely as: "Stability theory with applications to general problems". I decided to apply the work reported in the article to general problems in non-linear theory. My first article on the subject of the thesis was on this topic.

My second project was based on the "Constant coefficient method". My idea was to develop a new approach to the problem. While scanning through the newly displayed periodicals, I came across the following article:

252

O'SHEA (R P). A combined frequency-time domain stability criterion for autonomous continuous systems. (IEEE tran autom contr. AC-11;1967; 477-84).

In the work reported in this paper, Popov's method was used. I changed the methodology to suit my requirements, and applied it in my work. The result was satisfactory; it was very close to the classical theory.

My next step was to integrate the findings of projects 1 and 2 into a "Unified theory of stability". I examined the published documents on the subject quite extensively. But I could not get any guidance therein. Therefore, a new method was developed, which gives a systematic procedure for stability analysis of a wide class of systems not necessarily in differential form.

My project was completed in August 1968. A paper was sent for publication in SIAM j contr in Dec 1968. A few days later one of my colleagues got a note from Yale University reporting a similar work, that is, using the principle of differential inequality, but yielding different results and less general than that of mine.

CASE 7

1 Subject of Research

Some studies in linear and non-linear multivariable systems.

2 Summary of Narration

A thesis on the above subject was submitted about a year ago. Within six months after the date of submission and while the thesis was being examined by the referees, one of the latter came across a publication on the subject in a leading periodical. Of course, we could substantiate that the work on the project was completed and the thesis submitted a few months earlier to the appearance of the article. The referees accepted our point.

CASE 8

1 Subject of Research

Experimental evidence for the cavity theory of sorption-desorption hysteresis.

2 Summary of Narration

A survey of documents using Chemical abstracts indicated that no experimental evidence had been published in support of the above theory and therefore the subject was worth investigating.

Initially we thought of attacking the problem using two different methods:

1 By studying the effect of electric discharge; and
2 By studying the effect of ultrasonic vibration.

Our literature survey indicated that the effect of electric discharge on entrapped water in silica gel had not been studied. Apparatus and methodology described in published documents noted in our literature surfey was used and the work was completed

successfully in about four months. It has been reported in the Journal of colloid and interface science (1971 July).

Our literature survey also indicated that the effect of ultrasonic vibrations had not been examined earlier. In this case we could not find guidance from published documents for the conduct of the experiments.

Ultrasonic vibrations did not produce the expected effect in silica gel. Therefore, the work was given up after trying various possibilities.

Subsequently, information gathered from some text books (BLITZ (Jack). Fundamentals of ultrasonics. Ed 2. 1967; and CARLIN (Benson). Ultrasonics. 1960), available in the library, indicated that transducer materials, such as ferrite, may also produce the effect expected from using ultrasonic vibrations. The most efficient ferrite in this respect, as we could gather from published documents, was selected for the work. But we did not succeed. We prepared many combinations of ferrites based on the information available from books and periodicals in the library. But again we did not get the expected results. The problem was given up completely since we thought that it might take a considerable amount of time to investigate and understand the reasons for the failure and to find a solution to the problem, if at all possible.

CASE 9

1 Subject of Research

Burning mechanism of ammonium perchlorate.

2 Summary of Narration

Just about a year of starting the work on my project, we came across the following article:

WILLIAMS (F A) and others. A theory for the burning mechanism of ammonium perchlorate. (AIAA j. 1971 July).

This paper deals substantially with the same subject as that of my project. Therefore, we have to modify our work in progress.

CASE 10

1 Subject of Research

Mass transfer with pore generation.

2 Summary of Narration

The specific subject of my investigation was not fixed at the beginning. I started with the subject "Mass transfer from solid to liquid" and went on searching and reading relevant documents on the subject for about a year. I was also aware of a similar work on "Mass transfer from solid to liquid without chemical reaction", done by my predecessor in the department, and that the work was not too well appreciated.

Sometime in Jan 1969, I came across the article:

WEN (C Y). Non-catalytic-heterogeneous solid fluid reaction models. (Industr eng chem. 1968 Nov).

This article helped a good deal in clarifying some of the concepts in the subject of my investigation. In fact, I was able to define my field of work specifically as "Mass transfer with pore generation", that is mass transfer from solid to liquid with chemical reaction.

During my experimental work, the formulae for derivation of the values of several constants -- such as, reaction rate constants, saturation solubilities, densities, specific gravity, mass transfer coefficient etc -- were constructed on a theoretical basis, and the results obtained from experiments were compared. In the construction of formulae and for back ground information, papers in the Journal of the American Chemical Society and Kirk and Othmer's Encyclopedia were of considerable help.

CASE 11

1 Subject of Research

Solid gas reactions.

2 Summary of Narration

This work started about a year ago is, to some extent, a continuation of the work done in this department earlier (See Case 10). About six months

ago a report (Chem eng sc. 25;1970;1091) on a similar piece of work was brought to our notice. It, therefore, became necessary to modify the project by taking a different approach.

CASE 12

1 Subject of Research

Physico-chemical problems relating to the plant required for the manufacture of ketones from alcohols: Dehydrogenation of isopropyl alcohol to acetone.

2 Summary of Narration

I was working on the project during 1963-6. A year or so after I started work on the project, I came across the following article:

> FRANCKAERTS (J) and FROMENT. Kinetic study of the dehydrogenation of ethanol. (Chem eng sci. 19;1964;807-18).

It was a report on a work similar to the one I had taken up for my thesis. In particular, the statement "the ethanol based on the analysis of the liquid sample equalled that based on hydrogen production. Hence, ethanol was converted only by a single reaction, namely: $CH_3CH_2OH \leftrightarrows CH_3CHO+H_2$" supported and confirmed the interpretation I was making about the absence of side reactions. Further, I avoided analysis of the liquid product as the same result could be obtained by gas-analysis.

CASE 13

1 Subject of Research

Order-disorder transformations in metals: Tin systems.

2 Summary of Narration

A perusal of the book Constitution of binary alloys by Hanson indicated that nickel-tin systems had not been studied for the past twenty years. Olaf Nial's paper "X-ray studies on binary alloys of tin with transition metals" in Soensk kemisk tidsk, 1947 Sep, appeared to be latest publication on it. Therefore, we took up further investigation of nickel-tin systems. The work was proceeding satisfactorily for about two years, when we noticed a paper in Zeit anorg alg chem (1967) reporting on nickel-tin system using a methodology almost identical with that of ours. Needless to say this completely nonplussed us. To continue the work, we changed from nickel-tin system to a study of cobalt-tin system.

CASE 14

1 Subject of Research

Geochemistry of the alkali feldspars and origin of gold quartz veins in the precambrian of S E Mysore.

2 Summary of Narration

In 1964, I first took up a project on the "Geology, geochemistry and origin of gold quartz veins in the precambrain of Kolar", and started work .

About two and half years after that, our library had procured a complete set of Geochemica et cosmochimica acta, and while searching for documents on my subject, I noticed the following articles in the issues of the above periodical, V18 (1960):

VINCENT (E A) and CROCKET (J H). Studies in the geochemistry of gold. I. The distribution of gold in rocks and minerals of the Skaergaard intrusion, East Greenland. II. The gold content of some basic and ultrabasic rocks and stone meteorites.

Perusing these articles I found that my work was also proceeding on similar lines. Therefore, I thought it desirable to modify the subject of my project suitably. And this was done.

Later, I was casually glancing through the articles in the Journal of geology at the University Library. [I had gone there with my friend Dr ... to consult the Journal of petrology. But that library did not have it]. An article by K S Heier in V 65 (1957) of this periodical, attracted my attention and reading it led to another article by the same author in Norsk geol tidsk V 42 (1962). These two articles dealt with "gold in rocks and how it gets consolidated", or to put in another way "trace element distribution in feldspar". Since I had already worked for some time on feldspars of alkali, I thought I would develop my thesis on those lines. Hence the present title of my thesis. I completed the work last year.

260

Interviewer.- But Sir, when the project was given to you in 1964, did you do a complete survey of the relevant documents from the beginning, say using CA, BA and other abstracting periodicals? If this had been done, you might not have missed Vincent's paper which eventually led to some changes in the subject of your project.

Research Worker.- Yes, you are right. But I used a different method in surveying the literature on my subject. We sent out letters to almost all the specialists in the subject of my investigation, throughout the world, requesting each of them to send us reprints of any relevant papers. Dr Boyle is an authority on the subject and he sent us a bunch of reprints, covering the subject upto the year 1961. Since he is an authority on the subject, I saw no point in searching the abstracting periodicals for documents published earlier to 1961. Therefore, I searched for the documents published since 1961.

Interviewer.- Was not Vincent's article among the reprints received from Dr Boyle? Did you not come across a reference to Vincent's paper elsewhere.

Research Worker.- No, that is the unfortunate part of it; Dr Boyle's collection did not contain this paper, nor did I find a reference to it in any of the papers I had perused.

7 CONCLUSION

71 More Data Needed

The present study is confined to a small group of 32 research scholars, and out of this only about 50 percent had a case history of the use and impact of information on the research. If a generalisation of the findings regarding the different kinds of use of information mentioned in Sec 51 above is to be reliable, it is necessary that data is collected from a number of similar surveys of doctoral candidates in a number of academic_cum-research type institutions.

72 Implications

The case studies presented in Papers BA and BC of this Seminar and in the present paper, emphasise that information has a great impact on research work. Therefore, libraries must ensure that research workers are provided with information relevant to their work. Unintended duplication and the consequent modification and even dropping of projects involves considerable wastage of research potential. It is, therefore, necessary that research workers are provided with information pinpointedly, exhaustively, and expeditiously. The library and its document finding system must be designed to secure such service.

8 ACKNOWLEDGEMENT

I am thankful to Prof E S Rajagopal, Librarian-in-Charge, I I Sc Library, for his keen interest and encouragement in the work reported in this paper

and for permitting me to contribute it to the DRTC Seminar (9)(1971). I am indebted to Prof A Neelameghan, DRTC, for suggesting the work and for guidance in the preparation of the paper.

91 APPENDIX 1

Questionnaire

1 GENERAL

11 Name of Research Work:

12 Designation and Department:

13 Title of project:

14 Name of Guide/Supervisor:

2 TECHNICAL

21 Dates of starting and completion of project:

22 If not completed, whether the same project as was started with is being continued:

23 Who selected the subject of the project:
Guide, Student, Guide and Student

24 How did you come to select the subject:
1 Is it a continuation of the work you were engaged in earlier:
2 Is it a continuation of the

work the Department had taken up earlier:

3 Is it a new project:

3 CHANGE IN THE PROJECT

31 Was there any occasion when you had to modify, or drop the project and take up another subject. If yes, please answer the following:

32 What was the reason for the change:

1 Publication of similar work by other scientist .

2 Difficulty of access to the relevant documents

3 A large number of documents on the subject is published in languages not familiar to you.

4 Inadequacy of facility for research in the subject

5 Others:

33 What was the nature of impact or modification in the research necessitated by the publication of similar work by other scientists.

DRTC Seminar (9)(1971). Paper BJ.

OBSOLESCENCE AND UTILITY FACTORS OF PERIODICAL PUBLICATIONS: A CASE STUDY.

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[The respective values of the Aging Factor, Half life, Mean life, Utility factor, and Obsolescence factor of the periodicals Proceedings of the Institute of Radio Engineers, and Journal of the American Chemical Society are determined. The differences in the values of these factors for the two periodicals and also the variation in the values over a period of time for one and the same periodical, are commented upon. The usefulness of the findings of these studies in documentation service and in planning for the withdrawal of document is mentioned].

1 SCOPE OF THE PAPER

11 Characteristics of Periodical Publication

This paper reports the findings of a study of the factors mentioned below in respect of periodical publications:

1 Annual aging factor;

2 Obsolescence factor;

3 Half life;

4 Mean life;

5 Utility factor; and

6 The difference, if any, in some of the above factors in respect of articles in the field of Radio Engineering and Chemistry.

12 Pattern of Use of Documents

Information of the kind mentioned in Sec 11 is of help in finding out the pattern of use of periodical publications by specialists and also the pattern of change, if any, in such use over a period of time.

2 DEFINITION

The following definitions of technical terms as given by Line (5) have been used:

21 Apparent Obsolescence Factor

The Apparent Obsolescence Factor is the factor by which the active life of articles in periodicals appear to decay annually as calculated from the difference in the number of articles cited in successive years.

22 Corrected Obsolescence Factor

The Corrected Obsolescence Factor is the factor by which the active life of an individual article in a set of documents tends to decay annually.

23 Half-Life

The Half-life is the time (actual or expected) during which half the total use of individual articles constituting the documents in a subject has been or is expected to be needed.

3 PROCEDURE

The factors mentioned in Sec 1 can be determined by using the data on the pattern of citations of articles in a periodical.

31 Source of Data

For the subject Radio Engineering, the data about the citations of articles in Proc IRE for the period 1958-1962 and 1970 presented by Gundu Rao (3,4) have been used. For the subject Chemistry, the data about the citations in 10 per cent of the articles published in the Journal of the American Chemical Society (= JACS) for the year 1960 were collected. Also, the data about the citations in all the articles in the first two issues (Jan and Feb) of the same periodical for 1950 were collected. This was done to examine whether there is any variation in the pattern of citation of documents in the beginning of the year in relation to that for the whole year. There was no significant difference in the two patterns.

4 PATTERN OF DISTRIBUTION

41 Proc IRE

411 Table 1. Year of Publication of documents cited in Proc IRE, in 1970

Year of documents cited* (t)	N of documents cited 1970	Cumulative frequency T(t)
(a)	(b)	(c)
1970	324	4,423
1969	883	4,099
1968	642	3,216

Year of documents cited* (t)	N of documents cited 1970	Cumulative frequency T(t)
1967	579	2,574
1966	396	1,955
1965	362	1,599
1964	227	1,237
1963	177	1,010
1962	140	833
1961	98	693
1960	116	595
1959	70	479
1958	72	409
1957	46	337
1956	52	291
1955	22	239
1954	30	217
1953	27	187
1952	15	160
1951	30	145
1950	20	115
1949	11	95
1948	19	84
1947	43	65
1946	12	22
1945	10	10

*Comparatively very few documents published earlier to 1945 were cited in 1970. In fact, the total number of such documents was 36 over a 60-year period. Hence, these data are not given in the table.

412 Table 2. Year of Publication of documents cited for each of the years 1958 to 1962.

Year of doc cited*	N of documents cited for the year					Average N of doc cited in 1958-62
	1958	1959	1960	1961	1962	
1962	-	-	-	-	119	119

268

Year of doc cited*	N of documents cited for the year					Average N of doc cited in 1958-62
	1958	1959	1960	1961	1962	
1961	-	-	-	155	274	215
1960	-	-	134	292	124	183
1959	-	60	272	214	90	159
1958	64	198	156	92	64	115
1957	172	191	98	54	52	113
1956	174	116	72	49	33	89
1955	136	102	72	48	29	77
1954	79	99	38	46	25	57
1953	37	96	24	22	16	39
1952	68	54	19	26	13	36
1951	22	20	9	13	8	14
1950	9	13	14	23	11	14
1949	25	29	16	23	9	20
1948	9	13	11	9	17	12
1947	9	27	8	9	4	11
1946	13	11	10	5	2	8
1945	7	4	9	6	3	6
1944	6	6	6	5	1	5
1943	4	3	2	2	3	3
1942	6	2	2	-	-	2
1941	2	2	3	2	4	3
1940	5	1	5	1	4	3
1939	2	4	4	3	8	4
1938	3	3	5	2	1	3
1937	4	1	3	3	4	3
1936	6	6	6	-	1	4
1935	4	5	2	-	2	3
1934	2	2	-	2	2	2
1933	5	5	5	2	1	4
1932	3	3	-	1	1	2
1931	2	1	2	1	-	1

*Comparatively very few documents published earlier to 1931 were cited in the documents of 1958-62. Hence these data are not given in the table.

413 Frequency Polygon

Fig 1 given below is a frequency polygon for the data given in Table 1. Fig 2 is a frequency polygon for the pattern of the citation of articles in the Proc IRE for for 1961,1962 and for the grouped data for the period 1958 to 1962.

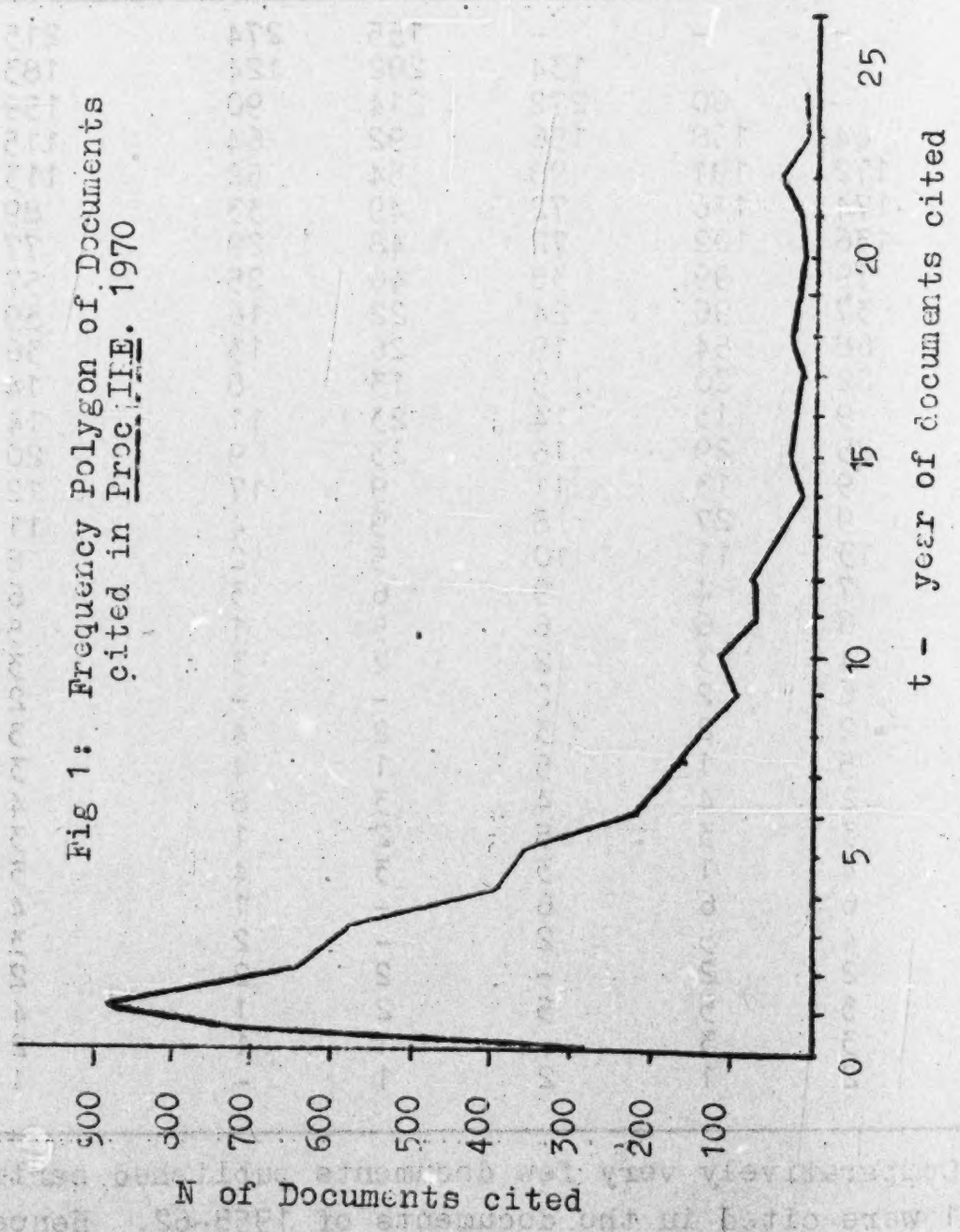


Fig 1: Frequency Polygon of Documents cited in Proc.IIE. 1970

270

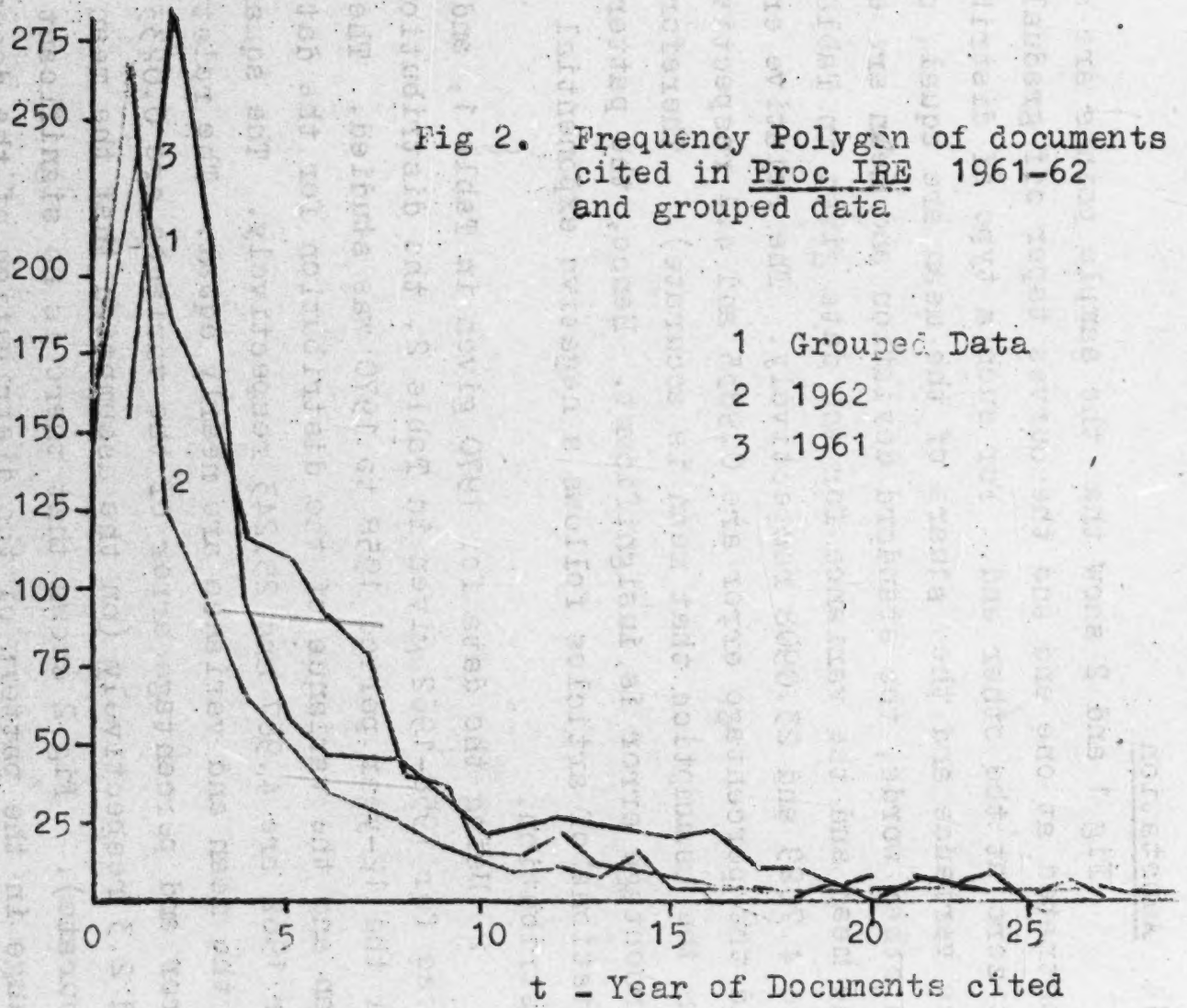


Fig 2. Frequency Polygon of documents cited in Proc IRE 1961-62 and grouped data

1 Grouped Data
2 1962
3 1961

414 Annotation

1 Fig 1 and 2 show that the sample points are concentrated at one end and the curves taper off gradually to zero at the other end. For such a type of distribution, the variance and the square of the mean are equal, or, in other words, the standard deviation and mean are equal. The mean and the variance for the data given in Table 1 are 4.7029 and 23.0908 respectively. The relative error and the percentage error are 0.9835 and 4.4 respectively (on the assumption that mean is accurate). Therefore, the percentage error is insignificant. Hence, the pattern of citations of articles follows a negative exponential distribution.

2 Using the data for 1970 given in Table 1, and those for 1958-1962 given in Table 2, the distribution for the 12-year period 1958 to 1970 was studied. The mean and the variance of the distribution for the data for 1962 are 4.967 and 25.243 respectively. The square of the mean and variance are nearly equal. The relative error and percentage error of the variance are 0.02331 and 2.3 respectively (on the assumption that the mean is accurate). Fig 2 shows that there is no significant change in the pattern of the distribution of the documents cited for the period 1958 to 1962 and also for the year 1970. However, the mean of the distribution has been shifting slightly.

3 It has been found that a negative exponential distribution can be fitted for the data on citation for each of the years 1958, 1959, ... 1962. It has also been found that a negative exponential distribution fits

with much higher confidence for the grouped data for the period 1958 to 1962 than for the data for any one of the years taken alone (See Table 3). This may be due to the fact that the errors get eliminated in averaging the number of documents cited. The relative error and the percentage error of the variance for the grouped data are 0.1838 and 0.7 respectivelv (on the assumption that mean is accurate).

415 Distribution Pattern

In Table 3 given below, a distribution has been fitted for two cases -- namely (1) Considering the data for 1962; and (2) Omitting the data for 1962.

Table 3. Year of Publication of Documents cited for the Grouped Data for the Years 1958 to 1962.

Year of documents cited* (t)	Average number of documents cited 1958 to 1962	Expected Frequency	
		By considering the data for 1962	By omitting the data for 1962
(a)	(b)	(c)	(d)
1962	119	284	-
1961	215	230	245
1960	183	187	201
1959	159	151	165
1958	115	122	135
1957	113	99	91
1956	89	82	76
1955	77	65	61
1954	57	53	51
1953	39	44	41
1952	36	37	34
1951	14	26	28
1950	14	23	23
1949	20	19	19

Year of documents cited* (t)	Average Number of documents cited 1958 to 1962	Expected Frequency	
		By considering the data for 1962	By omitting the data for 1962
(a)	(b)	(c)	(d)
1948	12	15	15
1947	11	12	12
1946	8	10	10
1945	6	8	8
1944	5	7	7
1943	3	5	6
1942	2	4	5
1941	3	3	4
1940	3	3	3
1939	4	2	2
1938	3	2	2
1937	3	2	1
1936	4	1	1
1935	3	1	1
1934	2	1	1
1933	4	1	1
1932	2	1	1
1931	1	0	0

* Comparatively few documents published earlier to 1931 were cited. Hence, these data are not given in the table.

416 Annotation

From Col d of Table 3, it can be seen that in the second case, the negative exponential distribution fits more accurately than it does for the first case. This may be due to the fact that in the articles published in 1962, it will not be possible to cite all the relevant articles published in tnat year 1962. In other words, the data for 1962 is incomplete.

42 Journal of the American Chemical Society

Studies similar to those done for the articles in the Proc IRE (See Sec 41 and its subdivisions) were carried out on the data on citations in the Journal of the American Chemical Society (= JACS) for the years 1950 and 1960. It has been found that the negative exponential distribution fits the pattern of citation of documents in JACS also for both the years 1950 and 1960. It has also been noted that there is no significant change in the pattern during the period 1950 to 1960 except that the mean of the distribution has shifted to the right. It is also worth noting that the mean life of the articles is greater in JACS than in Proc IRE.

5 ANNUAL AGEING FACTOR, HALF-LIFE, UTILITY FACTOR, AND OBSOLESCENCE FACTOR

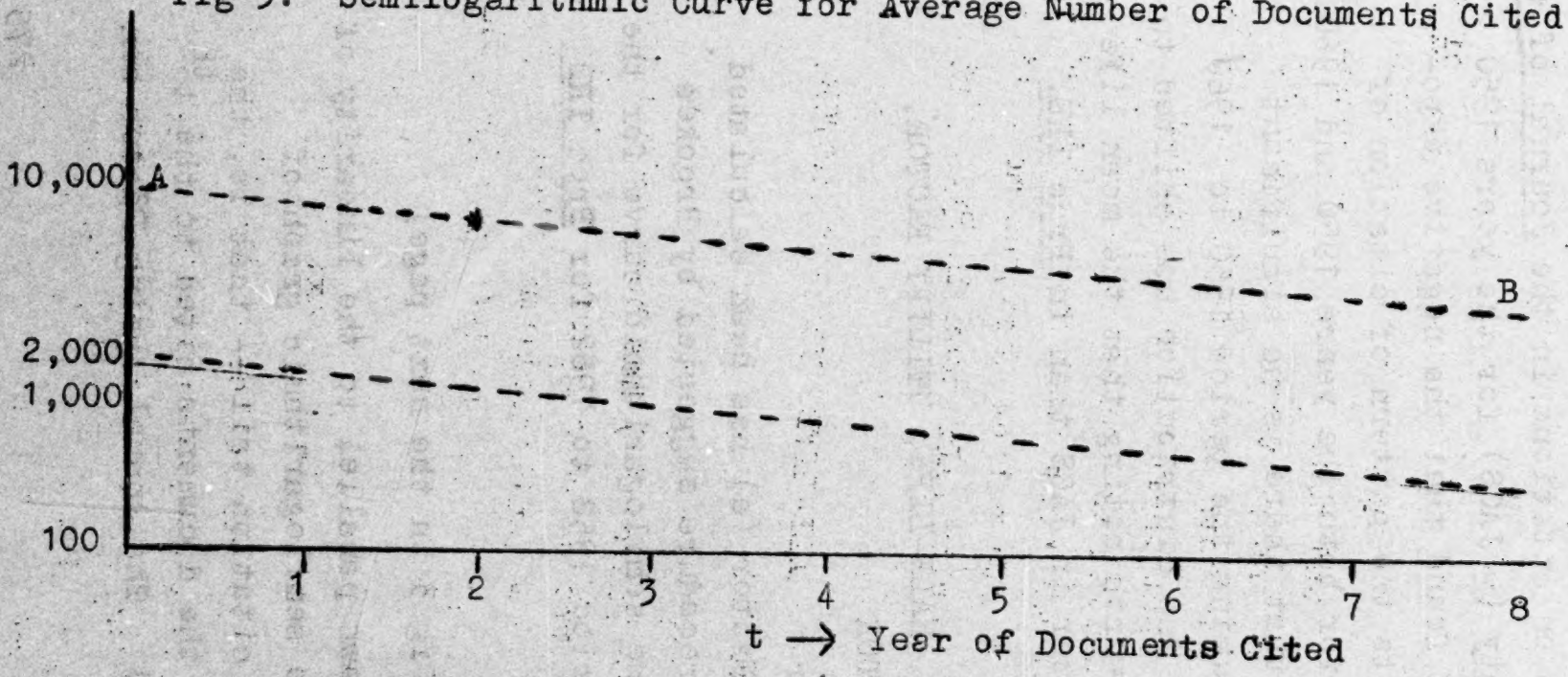
51 Annual Ageing Factor

The Annual Ageing Factor (a) has been calculated graphically using the procedure suggested by Brookes (1, 2). Fig 3 gives the semilogarithmic curve for the grouped data for the period 1958 to 1962 for Proc IRE (See Table 2, col g).

(See Fig 3 in the next page)

The straight line AB drawn parallel to the linearity of the plotted graph is the semilogarithmic graph of $T(t) = a^t$. $T(t)$ is the citation tail -- that is, the cumulative frequency of the documents cited to the t^{th} year. When $t=1$, $1=T(1)$. The Annual Ageing Factor can

Fig 3. Semilogarithmic Curve for Average Number of Documents Cited



be estimated from this relation. From the graph, we have $T(8) = a^8$. On solving this equation, we get a more accurate value for a.

From Table 4, it can be seen that the variation in the Ageing Factor in the successive years is insignificant, but it becomes significant over the period of 10 to 12 years and also for the grouped data.

52 Half-Life

The Half-life (h) can be determined from the graph such that the relation $a^h = \frac{1}{2}$ will hold good. The mean (m) of the distribution can be obtained from the Annual Ageing Factor (a), using the following relationship:

$$\frac{1}{m} = -\log_e a = \log_e \frac{1}{a}$$

This relationship is true if the distribution follows a negative exponential distribution.

53 Utility Factor

The Utility Factor (u) can be calculated using the relationship $u = 1/(1-a)$. This relationship shows that the Utility Factor will be very high when and only when the Annual Ageing Factor is high.

54 Obsolescence Factor

The Obsolescence Factor (α) has been calculated following the procedure suggested by Line (5) from the relation

$$\alpha = (0.5)^{1/m}$$

As in the case of the Annual Ageing Factor, from Table 4 given below, it can be seen that the variation of the Obsolescence Factor in the successive years is insignificant, but that it becomes significant over the period of 10 to 12 years and also for the graphed data.

277

Description	Proc IRE					
	1958	1959	1960	1961	1962	Grouped Data
Acting Factor (a)	0.8409	0.8126	0.8178	0.8409	0.8178	0.8567
Half life (Years) (h)	4.0	3.5	3.7	4.0	3.7	4.3
Mean life (Years) (m)	5.7765	4.8123	4.9667	5.4751	4.9667	6.4751
Utility factor (Years) (u)	6.2853	5.3362	5.4884	6.2853	5.4884	6.9
Corrected obsolescence factor (α)	0.8409	0.82038	0.82915	0.8409	0.82915	0.8548
u — m	0.5088	0.5239	0.5217	0.5088	0.5217	0.4249

continued —

Description	Proc IRE	Journal of American Chemical Society		Physics status solid*	Semi conductor physics (6)
	1970	1950	1960	1968	1963/1968
Ageing Factor (a)	0.80705	0.9576	0.9049	0.863	0.79**
Half-life (years) (h)	3.5	16.0	6.9	4.7	2.94
Mean life (years) (m)	4.6	23.2244	10.016	6.8	4.2397
Utility factor (years) (u)	5.2	23.5849	10.5762	7.3	4.76
Corrected obsolescence factor (α)	0.82038	0.9932	0.9331	0.9031	0.84915
u — m	0.6	0.3609	0.5002	0.5	0.5203

* These values have been calculated by Brookes (1,2)

** This value has been calculated by Line (5)

6 COMPARISON BETWEEN Proc IRE AND JACS

61 Annual Ageing Factor

From Table 4, it can be seen that for JACS the Annual Ageing Factor is high compared to that for the Proc IRE, Physics status solidi and semiconductor physics. For both the periodicals Proc IRE and JACS the value of the Annual Ageing Factor has decreased -- that is, from 0.8567 for the period 1958-62 to 0.8071 for 1970 in the case of Proc IRE and from 0.9567 for 1950 to 0.9049 for 1960 in the case of JACS.

62 Obsolescence Factor

The variation in the Obsolescence Factor is more significant for the period 1950 to 1960 in the case of JACS than it is for Proc IRE for the period 1960 to 1970. The Obsolescence Factor for JACS 1960 is the highest in comparison to that for the other three periodicals.

63 Half-Life

The Half-life is the lowest for Semiconductor physics (1968), and highest for JACS (1960). The data for JACS (1950) has not been considered as it relates only to the first two months of the year.

64 Difference between Utility Factor and Mean Life

The difference between the Utility Factor and Mean life (that is, u-m) is about 0.5 in most of the cases (See Table 4).

7 CONCLUSION

The data given in Table 4 shows that the value of the Average Ageing Factor is smaller for the more recent documents as compared to that for documents ten to twelve years older. Therefore, the utility factor has a lower value for the older documents than for the more recent ones. Studies similar to those described in this paper can be done on different varieties of documents and in different subject fields. Such information will be helpful in providing documentation service to specialists and in working out a programme for withdrawal from circulation of less used documents.

8 ACKNOWLEDGMENT

I am thankful to Prof A Neelameghan for suggesting the work reported in this paper and for guidance in writing it.

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BJ91 Ravichandra Rao

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C O N T E N T S

AREA 3 : COMPARATIVE STUDY OF SCHEMES FOR LIBRARY CLASSIFICATION

Paper	Author and Title	Page
CA	RANGANATHAN (S R). Dominant area for research in classification in the immediate future.	285-302
CB	BHATTACHARYYA (G). Classifying by UDC and by CC: A comparative study.	303-51
CC	JAYARAJAN (P) and GOPINATH (M A). Classification of complex subjects in CC and UDC.	352-70
CD	NEELAMEGHAN (A) and GOPINATH (M A). Fused main subjects.	371-404
CE	RANGANATHAN (T) and NEELAMEGHAN (A). Compatibility of UDC with a freely faceted version of CC: A case study.	405-33
CF	PARAMESWARAN (M). Geology in CC and UDC schedules.	434-45
CG	SEETHARAMA (S) and GOPINATH (M A). Classification of books on disease in medicine: A comparative study of CC and UDC class numbers. ..	446-66
CH	NEELAMEGHAN (A). Trend of research in notational system for library classification, with particular reference to the Colon Classification.	467-502

DRTC Seminar (9)(1971). Paper CA.

DOMINANT AREA FOR RESEARCH IN CLASSIFICATION IN THE IMMEDIATE FUTURE.

S R RANGANATHAN, National Research Professor in Library Science and Honorary Professor, DRTC, Bangalore-3.

[Two possible species of design are mentioned. The need for basing the design of a Scheme for Classification on a dynamic theory and for basing the theory itself on Canons, Postulates, and Principles for the Idea Plane, and the Canons for Verbal Plane and Notational Plane is stressed. While the findings of the Idea Plane are applicable to all Schemes for Classification, the schemes differ from one another in their notational system. There is not much scope for research in the Idea Plane. There is a great scope for developmental research in respect of the Notational Plane].

1 PROBLEM OF DESIGNING A SCHEME FOR LIBRARY CLASSIFICATION

11 The Purpose of a Scheme for Library Classification

The design of a Scheme for Library Classification aims at:

1 Arranging in a helpful Sequence all the subjects past, present, and future; The term 'Subject' denotes an organised or systematised body of ideas whose extension and intension are likely to fall coherently within the field of interest and comfortably within the intellectual competence and the

field of inevitable specialisation of a normal person;

2 Providing a translation of the name of each subject by a unique ordinal number denoted by the term 'Class Number', in order to maintain the preferred arrangement of subjects, the documents embodying them and to insert any new subject in its proper place; ordinal language of Class Numbers should be homonym-free and synonym-free in order that the Class Number of each subject is unique;

3 Denoting each subject by a unique technical term current among the specialists in the discipline; each term should preferably consist of a single word, unless the exigence of the language makes it necessary to prefix an epithet to it;

4 Constructing a schedule for application in the work of classifying; and the schedule will contain only numbers in the first column and their respective equivalent terms in the second column; but the idea forming the subject will not be explicitly visible in the schedule, even as Soul or God is not explicitly visible.

12 Two Species of Schemes for Classification

There are several species of Schemes for Classification. At one extreme is the Enumerative Classification typified by the Decimal Classification of Melvil Dewey. At the other extreme is the Freely Faceted Analytico-Synthetic Classification typified by version 3 of the Colon Classification, first

reached in Ed 6 and being refined in Ed 7 in preparation and likely to come out in 1972. Between these two extremes we can recognise three important species:

1 Universal Decimal Classification which veneered the enumerative DC core with time and space facets and another mixed facet prescribed for certain (BS) as analytical divisions;

2 Brown's Subject Classification providing a second facet, the isolate for which is to be taken from a separate schedule of "Categorical numbers".

3 Version 1 of CC which forced a rigid facet structure on every compound subject going with a particular (BS). Here every compound subject could have no more facets than those prescribed; and if any of the prescribed facets other than the last were absent, this should be indicated by inserting its indicator digit though no facet number follows it; this would result in 2 or more indicator digits coming in succession.

The gradual change over from Enumerative scheme to Freely Faceted Analytico-Synthetic scheme has been forced by the pressure of Universe of Subjects, with its dynamic never ending growth in its extension, and proliferation.

2 BASIS FOR DESIGN

21 Basis 1: Flair

One possible basis for design of Scheme for Classification is the flair of the Classificationist

perhaps helped by some guiding principles working at the sub-conscious level and even by an occasional dash of intuition. Virtually all the schemes beginning with DC and ending with version 1 of CC were designed in this way. At bottom it all turned out to be a rule-of-thumb.

22 Basis 2: Theory of Library Classification

A second possible basis for the design of Scheme for Classification is a set of objectively formulated guiding principles. These guiding principles will usually be embodied in a theory of Library Classification. A theory giving such guiding principles was first given in an incipient form in the Prolegomena to library classification, Ed 2, 1957. The theory has been more fully developed in its Ed 3, 1967. Since the Universe of Subjects is ever dynamic, any theory, capable of giving guiding principles to design a scheme for its classification, should itself be dynamic. The theory in the Prolegomena, Ed 3 has an element of such dynamism. A dynamic theory of classification implies of science of classification.

3 STRUCTURE OF THE SCINECE OF LIBRARY CLASSIFICATION

31 Planes of Work

In the dynamic theory of Classification, it has been found helpful to recognise three planes of work -- Idea, Verbal and Notational. The work in each plane can develop independently of each other, with the proviso that the Idea Plane is paramount and that the

Notational Plane should endeavour to implement all the findings of the Idea Plane. There is need for research in all the three planes.

32 Hypotheses or Normative Principles

Any science is usually based upon the formulation of a set of Hypotheses or Normative Principles. They do not admit of being either true or false. They are used only because they are helpful in explaining the observed facts and experience, and in the derivation of deduced principles disclosing possible new facts and experiances. The Hypotheses and Normative principles will loose their validity when the possible facts and experiences indicated by the deduced laws are found to be untrue. Then they are replaced by another set of Hypotheses or Normative Principles.

33 Levels of Hypotheses or Normative Principles

As in any other Science, in the Science of Classification also, special hypotheses and normative principles are usually needed at different levels of development. For convenience, the hypotheses or normative principles of each level are denoted by different terms in the Prolegomena. These are indicated in the succeeding sections. The reference in brackets given at various points is to the Chapters or Sections of the Prolegomena Ed 3, in which the concerned terms is formulated and explained.

34 General Laws of Thinking

To Level 1 belong the six General Laws of thinking, applicable to most if at all disciplines. (DC to DH).

Examples: Law of Impartiality (DD)
Law of Symmetry (DE)
Law of Parsimony (DF)

35 Laws of Library Science

To Level 2 belong the Five Laws of Library Science, applicable to the major discipline 'Library Science' (DB to DB5). These Laws are now well known.

36 Idea Plane

361 Postulates for Library Classification

To Level 3 belong the seven Postulates, pertaining to the Idea Plane in the sub-discipline 'Library Classification' (RB to RJ).

Examples: Postulate of Fundamental Categories (RB1)
Postulate of Isolate Facet (RD1)
Postulate of Level (RJ1)

362 Canons for Library Classification

To Level 3 belong also the fifteen canons pertaining to the Idea Plane in the sub-discipline 'Library Classification'. These fall into the following five groups:

1 4 Canons for Characteristics (EB to EF)
2 3 Canons for Succession of Characteristics (EG to EK)
3 4 Canons for Array (EL to EQ)
4 2 Canons for Chain (ER to ET)
5 2 Canons for Filiatory Sequence (EU)

Examples: Canon of Permanence (EF)
Canon of Concomitance (EH)
Canon of Exclusiveness (EN)
Canon of Decreasing Extension (ES)
Canon of Co-ordinate Classes (EU2)

363 Principles for Library Classification

To Level 4 belong the twenty-one principles pertaining to the Idea Plane in the subdiscipline 'Library Classification'. These fall into the following two groups:

1 4 Principles for facet sequence and sub-facet sequence (RM to RN)
2 17 Principles for Helpful Sequence (FB to FJ)

Examples: 1 Cow-Calf Principle (RN2)
2 Principles of bottom-upwards (FD21)
3 Principle of top-downwards (Fd22)
4 Principle of increasing complexity (FF1)
5 Principle of literary warrant (FH1)

37 Verbal Plane: Canons

To Level 3 belong the four canons pertaining to the Verbal Plane in the sub-discipline 'Library Classification' (GB to GE)

Example: Canon of Reticence (GE)

38 Notational Plane: Canons

To Level 3 belong the twentyfour canons pertaining to the Notational Plane in the Sub-discipline 'Library Classification'. These fall into the following four groups.

1 12 Basic Canons for Notation (JB to JH)
2 5 Canons for Mnemonics (KA to KE)
3 4 Canons for growing universe (LC to LG)
4 3 Canons for Book Classification (U to V)

291

Examples: Canon of Faceted Notation (JG2)
Canon of Scheduled mnemonics (KC)
Canon of Seminal mnemonics (KE)
Canon of Extrapolation in Array (LC)
Canon of Interpolation in Array (LD)

4 APPLICABILITY TO DIFFERENT SCHEMES

Work in Idea Plane is common to all schemes for Classification. Therefore the Postulates, Canons and Principles for Classification will be valid and will be found helpful in any scheme for classification. So also with the Canons for the Verbal Plane. On the contrary, the Schemes for Classification differ essentially in their Notational Plane. It is for this reason that some of the Canons for Notation are opposites of one another. A particular scheme may choose one or the other of these alternatives. But it is desirable that a particular scheme is consistent in its choice.

5 AREAS FOR RESEARCH IN THE IDEA PLANE

51 Limited Scope

The Idea Plane is not likely to develop any serious mutations, except, if at all at long intervals when the very mode of thinking of man undergoes sudden mutation. Therefore, the scope for research in the Idea Plane is not much. This does not amount to saying that there is no scope at all for research in the Idea Plane.

52 Postulates

Occasionally, altogether new kinds of subjects may appear, rendering the postulates in current use

unhelpful. According to the Spiral of Scientific method, described in the Five Laws of Library Science Ed 2, 1957, Sec 814, these postulates may then have to be replaced by a new set of postulates helpful in the new context. But the need for this may not be frequent. It is also possible that the postulates in current use may be replaced by a smaller number of postulates giving equally or even more helpful results. Research in this matter does not however, belong to the intellectual plane. Indeed it is not research at all. It is only a case of "Hit by intuition". This is indeed a characteristic of all kinds of Hypotheses and Normative Principles.

521 A Warning

Change of postulates cannot however be done by arm-chair remarks such as 'why five fundamental categories, why not four?' 'Why seven postulates, why not ten?'; some arm-chair librarians even ask, 'What is the sacredness of this five?'. Such an approach to postulates is only trivial. It may destroy, but not construct. The correct procedure for changing the number of postulates or any specific postulate, is a long and arduous one. Starting with a different set or number of postulates or with a negative of a particular postulate currently in use, an honest and serious person should meet all the problems already existing in the Idea Plane in Library Classification, and also those likely to arise. If they form a better set of postulates the problem of replacing the current ones by the proposed

new ones can be brought up for discussion.

522 Developmental Research and Postulates

A set of postulates have no doubt to be apprehended by intuition as a whole, unmediated by intellect. However, in the application of the postulates and in the interpretation of the terms used in them, the need may arise for intellectual research of the developmental kind. Indeed it has already occurred in respect of the postulates now current for the Idea Plane. This was due to the carry over of the use of the word 'Problem' in naming facets, in the rigid version of CC, before the freely faceted version replaced it. When the postulates were first postulated, the fundamental category 'Matter' was unconsciously equated with 'Material'. Further, the fundamental category 'Energy' was also taken to include certain concepts listed in a schedule. Obviously, this separate list was necessary because none of these concepts was Action. This was vaguely sensed in 1958, when Shri S Parthasarathy spent a few weeks in Bangalore. Our collective thinking led us to use the practice in thesaurus as authority for a Property or a Method as a manifestation of the fundamental category 'Matter'. But as I did not have an opportunity for some years thereafter to work with actual books in a library, this idea was not pursued. However, after the establishment of the DRTC, the problem was revived and the tentative decision made in 1958 to be all properties and methods as manifestation of fundamental category 'Matter' was experimented upon and finally

confirmed. One result of this was that the old special list of manifestations of the fundamental category 'Energy' was liquidated. Another result was the introduction of three kinds of manifestations of the fundamental category 'Matter'. These are now denoted by the terms and abbreviations given below:

1 Matter-Property (M-P)
2 Matter-Method (M-M)
3 Matter-Material (M-Mt)

It has also been found out that in practice in general no difficulties arise with regard to the sequence of these three manifestations of the fundamental category 'Matter' if they appear in the same Round.

53 Canons and Principles

The need for additions to or removal from the list of canons and principles in current use in the Idea Plane may arise now and then. These present scope for research in the work pertaining to the Idea Plane in Library Classification. This is only an intellectual problem. A comparison of these given by Richardson, Sayers, and in the three successive editions of Prolegomena bears testimony to the existence of scope for research from time to time in this area.

6 SCOPE FOR RESEARCH IN THE VERBAL PLANE

There is not as much scope for research in the Canons for work in the Verbal Plane as for that in the Idea Plane. However, a research attitude should be maintained in respect of the terminology used

in the schedules for classification, so that the library profession can do its best to stimulate the specialists in the different disciplines, in their work on Standard Terminology. In the case of library science however, the library profession itself should do the necessary research in building up a homonym-free, synonym-free, suggestive, and dynamic terminology. As a preliminary to this, the librarians should shed their allergy to the use of technical terminology in Library Science. Some years ago, this allergy led a member of the profession to, even to the extent of ridiculing the precise terminology in use, as 'Abracadabra'.

7 SCOPE FOR RESEARCH IN THE NOTATIONAL PLANE

Unlike in the other two planes, there is a never-ending scope for research in the Notational Plane. This is because of the obligation of the Notational Plane to carry out the various findings in the Idea Plane, in respect of the classified sequence of subjects. The Notational Plane has only a limited number of convenient isolated symbols to be incorporated in its different species of digits. The obligation on the one hand, and the limitation in the number of species and the total number of digits available on the other, provide the motive for continuing research in the Notational Plane. During the last one century -- the first century of Library Classification so to speak -- the Notational Plane has started with the Hindu-Arabic numerals as the only species of digits as

used in DC, passed through the addition of a few punctuation marks such as circular brackets, inverted commas and hyphen added by UDC, and reached the present stage of the Freely Faceted Version of CC using four species of digits -- a set of punctuation marks for use as indicator digits, Roman Smalls, Indo-Arabic numerals, Roman Caps, and even the one Greek Letter '△'. Even so many digits by themselves proved insufficient to meet the demands of the Idea Plane. Therefore, CC uses a number of devices, the most important of which are the Zone Device, Sector Device, the device of postulating certain digits as empty and emptying ones, certain other digits as merely empty digits and certain others as merely emptying digits, and 'Z' as an emptying digit to denote partial comprehension of what succeeds. With this buttressing, the versatility of the Notational Plane has increased considerably. This buttressing, had to be got after continued developmental research. But, this is only the beginning of our effort to improve the versatility of the Notational Plane. The demands of the Idea Plane may at any time transcend the capacity of the Notational Plane as it is to-day. Thus, the scope for research in the Notational Plane may be said to be ever present. If this is not done, the poverty in the versatility of the Notational Plane may inhibit the work in the Idea Plane, and prevent it from spreading its wings in its entirety as it were. This has been happening all through the century. This is bound to happen in the future also

unless research in the Notational Plane is continued.

71 Notational System of DC

711 The Pioneering Service of Dewey, the Genius

The Notational System of DC was designed about a hundred years ago, by Melvil Dewey, the great genius and pioneer. He not only designed a fairly enduring Scheme for Library Classification, but also made the librarians and readers alike accept the necessity and usefulness of classifying documents.

712 Classification of Books Only for the Then Readers

He made the scheme answer the needs of classifying the then current books. He did not think of the problems in classifying microdocuments as it would have made classification complex. Probably if he had attempted to cover both Macro and Micro documents, his invention might have had far less chance for acceptance. Therefore, as a true strategist, he confined himself to books. In this limitation, he had put on himself, Dewey naturally submitted to the Law of Least Action; and accordingly DC was designed with qualities necessary and sufficient for classification of books.

713 Micro Subjects of 1870's Attract Books by 1920's

DC was felt to be inadequate even within thirty years after its design and UDC was designed. By 1924, I found that subjects which had appeared only in articles -- that is, Micro Documents -- had begun to attract books on themselves. It is this which

made me sense that the foundation of library classification should be changed and that the foundation laid by Dewey was no longer adequate.

714 The Sad Death of Dewey Before Ed 1 of CC Could Reach Him

This led to the design of a faceted analytico-synthetic foundation for CC, in the place of the enumerative foundation of DC. On reading about my designing of CC in my Five laws of library science (1931), Dewey thought that I had designed a new scheme, only because Indological subjects were not properly represented in DC. Therefore, he wrote to me that if I sent him a list of Indological subjects, he would incorporate them in DC. As a veteran, he also warned me, a beginner, not to take the risk of designing a new scheme. However, I wrote to him that it was not the absence of Indological subjects in DC, and that he would appreciate the reason for my designing CC when he could peruse the CC in its printed form. I sent to Dewey a copy of the Colon Classification Ed 1, 1933, soon after its publication. But alas, it did not reach the other end before his death. My faith is that the genius of Dewey would have appreciated the need for a change in Notational System in order to classify the present day books.

715 Conservatism of DC Editors

But the Editors of the recent editions of DC seem to take it as obligatory that they should preserve

the Notational System of DC. In the Idea Plane they have accepted a few of the findings of the Theory of Library Classification, particularly of the Canons of Filiatory sequence. This is evidenced by the transfer of about a 1,000 Compound Subjects from one basic subject to another. But, they are not prepared to accept a change in the Notational Plane.

716 Scuttling

The following passage is taken from a letter of Mr Custer the editor of DC, published in the Library Association Record V62, 407, 1960. "We should like to point out that the use of mixed notation and of punctuation marks other than the decimal point, and the grafting onto DC base numbers of expansions and adaptations, constructed according to faceted or other unauthorized patterns, are not in accordance with Decimal Classification principles. Take DC or leave it, but pray do not tinker with it and then call us to account for the dissatisfaction you find in the results!" Old guards scuttling in the sense of 'Fly from danger or difficulty'.

72 Notation System of UDC

UDC has fully recognised all the results arising in the Idea Plane in the process of Library Classification. It is endeavouring at most to carry out the demands of the Idea Plane in the

Notational Plane. But its method of carrying it out is not a happy one. In particular, its Class Numbers are longer than what they can be. What is it that stands in the way of improving itself? It is its being prevented from giving up its long core schedule of DC, including not merely basic subjects but also compound subjects. In the notational Plane this is equivalent to its being prevented from doing active research in the Notational Plane or its adopting the results of research already done. What prevents change? In its earlier years -- almost till about 2 decades ago -- there was hardly any classificationist in the FID team for UDC. It was all managed, for each discipline, by the specialists in that discipline. Of late a few classificationists are admitted into that council. They have even a professional librarian appointed on their staff to take care of UDC. But, it is the scientist, without any experience in the discipline of library classification that form overwhelming majority in making decisions. This is due to the inheritance of the last seven decades or so. It is very much wished that this majority steps aside, and leaves the development of UDC in the hands of the classificationists belonging to the library profession.

8 KINDS OF RESEARCH

From Sec 5 to 7, it can be seen that there is scope for fundamental research -- particularly

in the Idea Plane, applied research in the Idea Plane, and for developmental research in all the planes and particularly in the notational plane.

Note.- In connection with this paper, the perusal of the following four earlier papers in the Library science with a slant to documentation V4;1967, will be worthwhile:

A RANGANATHAN (S R). Hidden roots of Classification

P --. Areas for research in library science.

Q NEELAMEGHAN (A). Research on the structure and development of the universe of subjects.

R -- and M A GOPINATH. Research in Library Classification.

DRTC Seminar (9)(1971). Paper CB.

CLASSIFYING BY UDC AND BY CC: A COMPARATIVE STUDY.

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A classified catalogue has to be based on a scheme for classification. The basis of the design of a classified catalogue is "Classifying". Each of UDC and CC is primarily meant to serve as a basis for designing a classified catalogue. Classifying according to UDC is compared with that according to CC. For this purpose, the principles governing the development of UDC in its formative stage, are distilled out from the"General Introduction", Outline Structure, Auxiliary Tables and from the schedules. Each distinctive feature of UDC is correlated to the relevant basic principles. The devices prescribed by UDC for classifying in conformity with its basic principles are discussed with illustrative examples. Classifying according to UDC for designing a Multiple Entry Classified Catalogue is demonstrated and the disadvantages of the latter are mentioned. The single Entry System prescribed by the Guide to UDC (1963) is discussed. The principles for determining Facet Sequence prescribed by the Guide are examined. It is shown that each of these principles has a corresponding postulate or principle, as the case may be, in the General Theory of Library Classification. The design and development of CC has been in conformity with this theory; and it has prescribed the Postulational Method of Classifying. An examination of the

principles of facet sequence prescribed by the Guide indicates that it intends to recommend the Postulational Method of Classifying, though inadequately, as prescribed by CC. It is shown that UDC has the necessary "flexibility" for being adapted for this purpose, though at the cost of some economy and effectiveness. To ensure economy and effectiveness, much rethinking on the design and development of UDC will be necessary. The use of the Postulational Method of Classifying by UDC is demonstrated with an example.

0 INTRODUCTION

01 Obligation of a Library Catalogue

A library catalogue must be equipped to satisfy a specific subject query. To satisfy a specific subject query, it has to provide information about the

1 Documents exclusively devoted to the specific subject;

2 Documents embodying subjects of extension greater than that of the specific subject, but having substantial portions devoted to it; and

3 Documents embodying subjects of extension smaller than that of the specific subject, but dealing with some facet of it.

The documents on the subjects collateral to the specific subject may contain some information, though indirectly, relevant to the purpose in hand. The library catalogue, therefore, is to provide further, the information about these documents.

02 Two Primary Forms of Library Catalogue

For the purpose of satisfying a specific subject query, a library may adopt either a

1 Classified Catalogue; or a

2 Dictionary Catalogue.

Each of these systems taken as a whole, serve other purposes also. In a classified catalogue only the classified part together with its subject index in the alphabetical part is meant to serve this purpose. In a dictionary catalogue, only the subject index made up of specific subject entries and of See also subject entries is meant to serve this purpose. Experience shows that in satisfying a specific subject query, a classified catalogue is far more efficient than a dictionary catalogue designed in the usual way (6).

03 Classifying

A classified catalogue has to be based on a scheme for classification. On the contrary, a dictionary catalogue has no such obligation. The basic operation governing the design of a classified catalogue is "Classifying". In a library, classifying ordinarily implies:

1 The use of a scheme for classification applicable to the universe of subjects, indicating implicitly or explicitly the associated succession of characteristics;

2 The assignment of each subject to the appropriate class of the scheme for classification, by

ascertaining the way in which each of the characteristics of the scheme is shared by it;

3 The synthesis of the class number of each subject;

4 The use of the class number for

Arranging the documents embodying subjects on the shelves,

Arranging the main entries and the cross reference entries in the classified part of the catalogue, and

Deriving the headings of the subject index entries; and

5 The creation of a new class, when necessary, in accordance with the prescribed postulates and principles governing the design of the scheme for classification (12).

04 Necessary Attributes of a Scheme for Classification

A knowledge of the postulates and principles governing the design of the scheme for classification used is, therefore, essential for a classifier. To help classifying for the purpose of designing a classified catalogue, a scheme for classification should therefore possess the following attributes:

1 It should mention explicitly the postulates and principles governing its method of design;

2 It should prescribe a systematic procedure based on the postulates and principles to arrive at the appropriate class number for a subject; and

3 It should also preferably prescribe a systematic procedure to derive subject headings from a class number constructed according to it.

05 Scope of the Paper

The Universal Decimal Classification (=UDC) is primarily meant for designing a classified catalogue. So also is the Colon Classification (=CC). This paper makes a comparative study of classifying by UDC with that by CC.

1 BASIC PRINCIPLES GOVERNING THE DEVELOPMENT OF UDC

11 DC as the Prototype

It is well-known that UDC is the result of remoulding and expansion in detail of the Decimal Classification (=DC) of Melvil Dewey. This was done under the auspices of the Institute International de Bibliographie. The purpose was to adapt it for classifying micro documents and to develop a classified catalogue for them.

12 Distilled Principles

There were some basic principles that governed the development of UDC. These principles are not explicitly stated. But they are either implied in the structure of UDC or implied in its General Introduction, Outline Structure, Auxiliary Tables, etc (17). It is possible to distil them out. Some of these distilled principles pertaining to the work in the idea plane and in the notational plane are given in the following sub-sections.

121 Principles for Work in the Idea Plane

1 A scheme for classification should be so designed that it can meet the requirement of the specialist as well as of the generalist by reconciling the conflicting interests wherever necessary.

2 A scheme for classification should accomodate any new formation in the universe of subjects.

3 A scheme for classification should reveal in its structure all the features which practical test of classifying has shown to be desirable.

4 There are no easily determinable "natural" relative sequence of the main subjects; on the other hand, the sequence of the main subjects in a scheme for classification, designed to meet a specific purpose, is always found to be reasonably helpful.

5 No theory of relative collocation of the main subjects is free from particular bias; and any alternative arrangement is open to adverse criticism, if a suitable standpoint is selected.

6 A concept by itself is always not a subject; but there are factors which define such a concept sufficiently for it to become a constituent of a compound subject. For example, "Iron" is a concept not capable of being deemed to be a subject by itself, but it is a constituent concept in the compound subject "Iron ore deposits", "The element iron", and "Metallurgy of iron".

7 There are constituent concepts which may go with any subject -- such as, the constituent

concept of "Space" and the constituent concept of "Time" -- each of which may be called a "Common Auxiliary Subdivision".

8 There are constituent concepts which may normally form part of most of the compound subjects going with a restricted number of main subjects -- such as, the constituent concept of "Different kinds of parts of a machinery" and the constituent concept of "Shape of products", which may form part of several compound subjects going with the different main subjects in "Applied sciences" — each of which may be called a "Special Auxiliary Subdivision".

9 A scheme for classification should recognise the Common Auxiliary Subdivisions and the Special Auxiliary Subdivisions; and it should categorise them helpfully in their respective schedules to achieve economy in the length of the schedules by avoiding repeated enumeration.

10 A scheme for classification should prefer to prescribe devices to form, or extend, or sharpen a subject or a concept to achieve economy in the length of the schedules by avoiding repeated enumeration.

11 There is no logical sequence of the "Constituent Concepts" of "Subject"; and a "Subject" is, to this extent, an arbitrary subdivision of each of of its "Constituent Concepts"; for example, the subject "Mining for Copper in England" may be deemed by different specialists to be a subdivision of either the concept "Mining", or of the concept "Copper" or of the concept "England".

12 The arrangement of the compound subjects, going with a main subject should be according to the principle of "From Groups of Wide Extent to the Groups of Less Extent" without any undue stress on any theory of relative collocation of the main subjects.

122 Principle for Work in the Notational Plane

1 The notation of a scheme for classification should admit of infinite interpolation between any two members without disturbing the sequence of the original numbers in a series.

2 The notation of a scheme for classification should consist of the series of indeterminate, infinitely extended decimal fractions.

3 The digits constituting the base of the notation of a scheme for classification should preferably be universally understood.

4 A scheme for classification should include the notational devices to guide the construction of a number for a subject or for a concept not enumerated in the schedule.

5 The notation of a scheme for classification should be fully equipped to admit of the construction of a class number by assembling the pertinent "Simple Constituents" each representing a Constituent Concept.

6 The number of digits in a "Simple Constituent" should ordinarily be as many as can be readily assembled in the mind and transcribed on to paper.

7 In the notational plane, a scheme for classi-

fication should be "Synthetic" -- that is, its notation should admit of the construction of multiple class numbers for the same subject by permuting the sequence of the "Simple Constituents" involved -- as distinct from a purely "Analytic" one, which prescribes one and only one sequence of the "Simple Constituents" for the construction of one and only one class number for each subject, specially of a compound subject.

8 The advantages of a Synthetic Scheme outweigh the disadvantages occasioned by the vagueness in the specification of the sequence of the resulting compound classes.

9 As far as necessary and sufficient, a class number should be coextensive with the subject represented by it.

10 The practical usefulness of a scheme for classification is much more concerned with making provision for classifying coextensively than with restricting the number of digits in a class number.

123 Restrictive Coextensiveness

The basic principles enumerated as categories 8 and 9 above prescribe classifying coextensively. The intention of these principles is to be understood in the light of the following empirical principles found embedded in "Rules for Classifying" given in UDC (17).

1 Over-elaboration of a class number confuses an unskilled user, defeats the object in view, and results in waste of time.

2 To avoid over-elaboration of a class number,

the use of the numbers for Auxiliary Subdivisions, both Common and Special, should be kept restricted to the minimum.

3 For the classified part of the catalogue of a general library, the class number should be worked out as brief as will allow the entry to be segregated within a reasonably small group, say, not exceeding 20 to 50 entries.

4 For the classified part of the catalogue in a specialist library, the class number may be constructed to be coextensive with the specific subject represented by it; but it is necessary to keep the use of the numbers for Auxiliary Subdivisions, both Common and Special, restricted to the minimum. For example, the class number for the subject "Copper mining in Utah" may be worked out as for the subject "Mining of Copper Deposits", and it may be used for the Main Entry. If the space aspect is considered helpful, a separate class number for the subject "Mining in Utah" may be worked out and it may be used for another Main Entry or for Cross Reference Entry.

5 For the purpose of shelving, the Class Number may be worked out even briefer than that worked out for the Main Entry in the Classified Part of the Catalogue.

2 DISTINCTIVE FEATURE OF UDC

21 Root

It is evident that many of the principles that governed the development of UDC were the same as those governing the design of DC. However, the princi-

ples enumerated in Sec 121, 122 and 123 above additionally furnish the necessary explanation for UDC choosing DC as its prototype, as well as for its deviation from DC. It may be noted that of all the principles, the following are primarily responsible for the significant distinctive features of UDC:

1 The principle ruling out any "logical" sequence of the Constituent Concepts in the name of a subject in the idea plane (See Category 10 in Sec 121);

2 The principle preferring a "Synthetic" scheme as distinct from a "Purely Analytic" one in the notational plane (See Categories 6 and 7 in Sec 122); and

3 The principle prescribing coextensive classifying of each subject in the notational plane (See Categories 8 and 9 in Sec 122 and 123).

22 Consequence

220 Classified Catalogue Envisaged by UDC

The principles forming the root of the distinctive feature of UDC have their impact on the classified catalogue envisaged by UDC. As a result, this is to consist of the

1 Classified part made up of the Main Entries and the Cross Reference Entries under the multiple class numbers for each specific subject; and

2 Alphabetical part made up of general subject entries.

221 Grouping of Subjects

Classifying by UDC has to be in conformity with the principles forming the root of its distinctive

313

feature. As a consequence, UDC distinguishes the subjects to be classified by it, into the following two groups:

1 Subjects warranting "Simple Decimal Numbers" for their respective representation; and

2 Subjects warranting "Compound UDC Numbers" for their respective representation.

The term 'Simple Decimal Number' refers to a Class Number used in the main table to represent a mutually independent class. The term 'Compound UDC Number' refers to a Class Number synthesised by combining two or more of the Simple Decimal Numbers or by combining one or more numbers for Auxiliary Subdivisions with one or more Simple Decimal Numbers.

222 Sequence of Components

In the case of a subject warranting a Simple Decimal Number for its representation, UDC does not recognise any component; and therefore, in constructing the class number, the question of the sequence of the components does not arise. In other words, the sequence of the components, if there are any, is already fixed by UDC; in such a case, the classifier has nothing to do in this respect.

223 Resolution of Conflict

According to UDC, it may be possible to construct the class number for a specific subject in more than one way. This situation gives rise to a conflict of class numbers. To resolve such a conflict, UDC has prescribed the following rules:

The choice of the right class number from among

two or more class numbers for a specific subject should be governed by the following sequence of preference:

1 The Simple Decimal Number, having the lowest ordinal value;

2 The Compound UDC Number with a point-naught component number, having the lowest ordinal value;

3 The Compound UDC Number with a hyphen component number, having the lowest ordinal value;

4 The Compound UDC Number with an apostrophe component number having the lowest ordinal value;

5 The Compound UDC Number with a point-double-naught component number, having the lowest ordinal value; and

6 The Compound UDC Number with a Common Auxiliary Subdivision Number.

224 Prescription for Multiple Entries

UDC has explicitly declared that there exists no "logical" sequence of the components of a subject. But, it still prescribes a sequence of the components of a Compound UDC Number. This appears to be contradictory. But in reality, this is not so. The prescription of sequence is to help in constructing just one of the several class numbers, which may be helpfully permuted to construct the other class numbers for the same compound subject. It may also be noted that the prescription of the sequence of the components made up of Simple Decimal Numbers and of Compound UDC Numbers with a Special Auxiliary Subdivision Number, is too vague to provide any objective guidance. This feature also is quite in conformity with the pertinent basic principle ruling out any

315

logical sequence of components. The other reason for this prescription appears to be to restrict the permutation of the components made up of Common Auxiliary Subdivision Numbers; because this is deemed to be unnecessary for general purpose. However, to pay full respect to its pertinent basic principle ruling out any logical sequence of components, UDC prescribes the following:

1 Construct multiple class numbers for a specific compound subject for the preparation of multiple main entries or cross reference entries under them for the classified part of the catalogue by permuting the component numbers -- specially those made up of Simple Decimal Numbers and of Compound UDC Numbers with a Special Auxiliary Subdivision Number -- of its full Compound UDC Number. If necessary, permute the component numbers made up of Common Auxiliary Subdivision Numbers.

2 Construct, if necessary, multiple main entries for a specific compound subject for the preparation of Main Entries or Cross Reference Entries under them for the classified part of the catalogue, by interpolating (or intercalating) the compound numbers representing either a place-subdivision or a time-subdivision or a subject-subdivision.

225 Devices In UDC

Besides the extensive use of the Enumeration Device, the basic principle about the preference of devices to achieve economy in the length of the schedules, as well as that of coextensively classifying, has led UDC to make explicit provision of several additional

316

devices for forming, or extending, or sharpening, as the case may be, for a subject or a concept, both in the idea plane and in the notational plane. These devices may be named and explained as follows:

1 Partial Comprehension Device.- Device for forming a Partial Comprehension of two or more subjects or concepts for which no single comprehensive subject or concept, as the case may be, is enumerated in the schedule, by increasing the extension of one of the subjects or concepts involved. The construction of the number for a partial comprehension of two or more subjects or of concepts is governed by the following rules:

11 Determine the distinct subjects or concepts as the case may be,

12 Construct the number for each distinct subject or concept,

13 If the numbers constructed are non-consecutive with reference to the schedules, then arrange the numbers in the increasing sequence of their respective ordinal values, and use the indicator digit ' + ' (plus) to combine each with its immediately preceding number.

Example:

622+669 Mining and Metallurgy;

(46)+(72)+(8) Spain, Mexico, and South America

14 When the number is for a partial comprehension of two or more subjects, construct multiple class numbers for the preparation of multiple main entries for the classified part of the catalogue, by cyclic permutation of the components of the class number concerned.

317

Example:

669+622 Metallurgy and Mining; and
622+669 Mining and Metallurgy.

15 When the number is for a partial comprehension of two or more subjects together constituting a more or less comprehensive study of a subject or of a concept, the whole class number may be replaced by the class number having the lowest ordinal value followed by the indicator digit ' + ' (plus).

Example:

159.9+ for 159.9+159.923+301.151+616.89+65.013 (= Psychology, individual, social, medical and industrial).

The number constructed in this way is to be used for the main entry. In such a case, use each of the other component class numbers followed by the indicator digit ' + ' (plus) as a distinct class number for the preparation of a cross reference entry.

Example:

159.923+, 301.15+, 616.89+, and 65.013+.

16 If the numbers constructed are consecutive with reference to the schedules, arrange the numbers in the increasing sequence of their respective ordinal values, select the number with the lowest ordinal value, put after it sucessively the indicator digit ' / ' (virgule), and the number with the highest ordinal value to construct the numbers for the partial comprehension.

Example:

692/599 Systematic zoology (equivalent to (592+593+ ...+599).

2 Chronological Device.- Device for sharpening a subject or a concept on the basis of the chronological characteristic -- that is, by using a time-concept as its qualifier -- provided no such sharpened subject or concept is already enumerated in the schedule.

In the notational plane, it consists of interpolating (or intercalating) the time-number with its specific enclosing indicator digits at the appropriate place in the class number for the subject without the qualifying time-concept.

Example:

420"01"-5 Grammar of Old English

3 Geographical Device.- Device for sharpening a subject or a concept on the basis of the geographical characteristic -- that is, by using a place-concept as its qualifier -- provided no such sharpened subject or concept is already enumerated in the schedule.

In the notational plane, it consists of interpolating (or intercalating) the place-number with its specific enclosing indicator digits at the appropriate place in the class number for the subject without the qualifying space-concept.

Example:

72(540)1 72(540)"15"6.2 Moghul architecture of mosques

3 Subject Device.- Device for sharpening a subject either

1 On the basis of a subject characteristic -- that is, by using another subject; or

2 On the basis of a characteristic, other than a chronological or geographical characteristic, already

319

used in the schedule to sharpen some other subject -- that is, by using a concept already used in the schedule;

provided no such sharpened subject is already enumerated in the schedule.

When the sharpening is on the basis of a subject characteristic, in the notational plane, the device consists of the following steps:

1 The class number for the host subject is worked out;

2 The class number of the sharpening subject is worked out; and

3 The class number for the sharpening subject is connected with the class number for the host subject by using the indicator digit ':' (colon).

Example:

159.9:37 Psychology for teachers
32:91 Geopolitics
17:7 Morals in art
31:63 Agricultural statistics
016:61 Bibliography on medical sciences

When the sharpening is on the basis of a characteristic already used in the schedule, then in the notational plane, the use of the device consists of the following steps:

1 The class number for the host subject is worked out;

2 The number for the sharpening concept is taken to be the whole class number in which the pertinent concept is represented by its terminal digit/digit-group; and

3 The number for the sharpening concept is connected with the class number for the host subject by using the indicator digit ':' (colon).

Example:

616.1-085:615.531 Homoeopathic treatment of hear diseases

In this example, the subject "Treatment of heart disease" is to be sharpened on the basis of the characteristic "system of treatment". There is no such sharpened subject already enumerated in the schedule. Search in the schedule shows that the same characteristic has been used in the schedule to sharpen the subject "Pharmacology"; and the number for Homoeopathic Pharmacology is 615.531, in which the concept "Homoeopathy" is represented by the terminal digit-group '31'.

The number for the subject "Treatment of heart disease" is 616.1-085. For the purpose of sharpening this class number, the number for the concept "Homoeopathy", in this case, is to be taken to be 615.531. This number connected by a colon with the host class number gives rise to the sharpened class number 616.1-085:615.531, which represents the subject "Homoeopathic treatment of heart disease". It may be noted in this case, that the number '615.5' in the sharpened class number serves the function of helping the right interpretation of the digit-group '31', the number '615.5' itself loosing its semantic content.

If the sharpening subject does not warrant an

entry under its class number to provide access to the sharpened subject, in the notational plane, the class number for the sharpening subject enclosed in square brackets, is added after the class number for the host subject.

Example:

620.174[669.14] for 620.174:669.14
Material testing - bend test [for steel]

A class number admitting enclosure in square brackets may be interpolated (or intercalated) at any desired point in the class number for the host subject. For example,

Example:

620.1[669.14]74 Material testing [for steel] bend test.

5 Concept Device.- Device for

1 Sharpening a concept on the basis of a characteristic already used in the schedule -- that is, by using another concept; and

2 Creating a complex concept by bringing two concepts of the same category in relation to each other;

provided no such sharpened or complex concept is already enumerated in the schedule.

In the notational plane, the sharpening of a concept number consists of the following steps:

1 The number for the host concept is worked out;

2 The number for the sharpening concept is worked out;

3 The number for the sharpening concept is connected with the number for the host concept by using the indicator digit ':' (colon).

Example:

(540:213) Tropical India.

"1963:322" Summer of 1963.

In the notational plane, the creation of a complex concept consists of the following steps:

1 The number for each of the concepts is worked out;

2 - The number having the lowest ordinal value is regarded as the first component of the complex concept number; and

3 The number having the higher ordinal value is connected with the first component by using the indicator digit ':' (colon);

Example:

341.63 (44:45) Arbitration between France (44) and Italy (45).

Note.- A class number having a complex concept number worked out in the way mentioned above, is to be used to construct another class number by permuting its components.

Example:

341.63(45:44) Arbitration between Italy and France

341.63(44:45) Arbitration between France and Italy.

6 Alphabetical Device.- Device for sharpening a subject or a concept, as the case may be, on the basis of the name characteristic -- that is, by using the name of an individual entity, such as the name of a person, corporate body, work (title), concept, natural object (constellation, chemical element, plant species, animal species), machine, and object of any kind -- provided no such sharpened subject or concept is already enumerated in the schedule.

In the notational plane, it consists of several options as follows:

11 In the case of a name-of-person, the full name may be rendered in the sequence "the surname, a comma, and the forename"; and the rendered name in full may be added directly or enclosed in brackets, after the number for the host subject or concept; or

12 The surname alone may be added; or

13 A suitable abbreviation of the surname may be added.

Example:

92 Schiller, Friedrich
92 (Schiller, Friedrich)
92 Schiller
92 (Schiller)
92 Schil/
92 (Schil/)
92S
92(S)

21 In the case of a name-of-corporate body, its standard abbreviation, if any, or the initials of its substantive words may be added directly or

enclosed in brackets after the number for the host subject or concept, as the case may be.

Example:

061.4(42)I.C.I or 061.5(42)(I.C.I) or 061.5(42)ICI or 061.5(42)(ICI)	Imperial Chemical Industries

22 The number for a multiworded name of a work (title) may be constructed in a way analogous to that for a name-of-corporate body.

31 In the case of a name-of-concept, its standard name in full may be added directly or enclosed in brackets after the number for host subject, or concept.

32 The number for a name of natural object, a machine, and an object of any kind, may be constructed in the way analogous to that for a name-of-concept.

7 Numerical Device.- Device for sharpening a subject or concept, as the case may be, on the basis of the numerical name characteristic -- that is, by using the number of an individual entity, if any, -- provided no such sharpened subject or concept is already enumerated in the schedule.

In the notational plane, it consists of adding after the number for the host subject or concept, the number (numerical entity, with the symbol "No." prefixed to it.

325

Example:

656.4.02(492.621)No.12

Amsterdam tram services, line No.12

226 Notational Preference

The basic principle ruling out any logical sequence of the component concepts and the principle prescribing multiple class numbers have led UDC further to prescribe notational preference in some cases. Of these, the important one is concerned with the use of Special Auxiliary Subdivision Number. According to UDC, the number for the subject "Automatic control in foundries" is 621.74-52. But UDC prefers the number '621.74:621-52'. For, the latter alone can be permuted to construct another class number to prepare another Main Entry under it for the classified part of the catalogue. For the same reason, a number, such as

159.9+159.923+301.15+616.89+65.031 (=Psychology, individual, social, medical, and industrial)

is preferred to the number 159.9+.

227 Provision of the Schedule of 'Point-of-View Concepts

The principle prescribing that the scheme for classification should meet the special requirement of the specialist has led UDC to make provision for the schedule of "Point-of-view concepts". They satisfy the criterion of Common Auxiliary Subdivisions. Use of these concepts ultimately amounts to the development of a special scheme for classification to meet the special requirement of the specialists.

326

The indicator digit for 'Point-of-view' is '.00' (point-double nought). A class number followed by the point-of-view number is further sharpened by Subject Device.

228 Ordinal Values of the Digits

The principle of preference of a "Synthetic" scheme for classification to a "Purely Analytic" one (See Principle 7 in Sec 122) has led UDC to introduce several indicator digits. To implement the principle of "From Groups of Wide Extent to the Groups of Less Extent", for the arrangement of compound subjects going with a particular main subject (See Principle 12 in Sec 121), in the notational plane, UDC has assigned to each of these digits an ordinal value. All the digits forming the base of the notational system of UDC may be categorised broadly into two groups -- viz, Indicator Digits, -- for example,

+, /, :, ⌜ ⌟, or (( )), =, (0...), (...), (=...), " ", .00, -, and .0, ' , .

and Substantive Digits, for example, A or a/Z or z, and 0/9. Among the indicator digits + and / constitute the Anteriorising Group. The rest constitute the Posteriorising Group. Among the Indicator Digits in the Posteriorising Group, the ' : ' (colon), .00, -, .0, and ', constitute the Non-packeting Group, and the rest constitute the Packeting Group. An analysis of the demonstration of the arrangement of class number given by UDC leads us to the following conclusion about the ordinal value of

327

each digit of its notational system:

1 When arranged in the increasing sequence of their respective ordinal value, the digits in the Anteriorising Group fall in the following sequence:

+ /

2 When arranged in the increasing sequence of their respective ordinal value, the digits in the Posteriorising Group fall in the following sequence:

} going with (A or a/Z or z
} going with (=
) going with (1/9
" going with "1/9
) going with (0
= going with = 1/9
⌋ or)) going with ⌈1/9
⋮
⌈ or ((
=
()
..

"
(1/9
(=
(A or a/Z or z
or A or a/Z or z
.00
-
.0
,
.
0/9

Even without going into the details of the respective ordinal values of the digits, it may be stated here that UDC has failed to implement its principle of "From Groups of Wide Extent to the Groups of Less Extent" in the notational plane, in its assignment of ordinal value to each indicator digit.

229 Subject Index to the Classified Part

The construction of the subject index to the classified part of the catalogue, has to be closely linked up with classifying. Specially, the procedure for deriving subject heading can be made systematic if it is based on the class number for the subject. DC demonstrated the helpfulness of

328

this principle in its Relative Index. We have seen that UDC, though based on DC, developed its distinctive features on the basis of some principles of its own. But, in regard to the derivation of a subject heading, no such unique principle is discernible. In fact, principles regarding the subject index is too broad to provide any substantial guidance in deriving subject headings. Nor do its own indexes to the different fascicules provide a substantial base to search for any implied principles. However, the following appear to be the principles implied in its statement regarding the subject index:

1 The alphabetical subject index to the classified part of the catalogue is to take the form of a "Relative Index".

2 Each entry in the relative index is to correlate a specific subject with the class number for it.

3 The subject heading for a specific subject is to consist of a specific part, followed by a contextual part.

4 Each term constituting a subject heading should be "ordinary".

DC has not explicitly stated the principles governing the derivation of the subject headings for its relative index. But its excellent demonstration of the construction of a relative index is to a great extent self-expository of its major principles. Research in this respect has led to the formulation of several such principles (1). But the use of this procedure on class numbers con-

structed according to UDC calls for an elaborate set of rules. But neither UDC has provided these rules; nor any substantial work is known to have been done to formulate such rules. More research is necessary on this subject.

3 EXAMPLE OF CLASSIFYING

31 Multiple Class Number

In Sec 2, we have taken note of the major elements constituting the distinctive features of UDC. Let us now classify the documents, each embodying one of the following subjects, coextensively disregarding the prescriptions of restriction, if any, on the basis of all the principles of UDC to develop a classified catalogue -- that is, the Classified Part and the alphabetical subject index.

1 Encyclopaedia of general practice

61(031)(EGP)
(031)61(EGP)

2 Medical journal of Australia

61(051)(MJA)
(051)61(MJA)

3 Biographical history of medicine brought upto 1950's

61(092) 61(100)"195"(091)
92:61 (091)61(100)"195"

4 Development of medicine in Great Britain during the war period (1939-1945).

61(410)"1939/1945"(091)
(410)61"1939/1945"(091)
"1939/1945"61(410)(091)
(091)61(410)"1939/1945"

5 Biography of Galen

61(092)(Galen)

6 Indian Medical Association

061.22:61(540)(IMA)
61:061.22(540)(IMA)

(540)061.22:61(IMA)

7 Research in Medicine in India in 1970's

61.001.5(540)"197"
(540)61.001.5"197"

8 Human anatomy

611

9 Human physiology

612

10 Human diseases

616

11 Difference between personal hygiene and public health

613:614 (Difference)

614:613 (Difference)

12 Human heart: its anatomy and physiology

611.12+ 612.17+ or 611.12 + 612.17 / 612.17 + 611.12

13 Anatomy of human heart and lungs

611.12+ 611.24+ or 611.12 + 611.24 / 611.24 + 611.12

14 Human respiratory system: its anatomy, physiology and diseases

611.2+ 612.2+ 616.2+ or 611.2 + 612.2 + 616.2 / 612.2 + 611.2 + 616.2 / 616.2 + 611.2 + 612.2

15 Human lungs: its anatomy physiology, and diseases

331

611.24 + 612.24 + 616.24 or 611.24 + 612.24 + 616.24
612.24 + 611.24 + 616.24
616.24 + 616.24 + 611.24 + 612.24

16 Anatomy of lungs

616.24

17 Physiology of lungs

612.24

18 Diseases of lungs

616.24

19 Treatment of the diseases of lungs

616.24:616.08
616-08:616.24

20 Therapeutic treatment of the diseases of lungs

616.24:616-085
616-085:616.24

21 Therapeutic treatment of the infectious diseases of lungs

616.24:616.9:616-085
616.9:616.24:616-085
616-085:616.24:616.9

22 Therapeutic treatment of the infectious diseases of lungs of children

616-053.2:616.24:616.9:616-085
616.24:616-053.2:619.9:616-085
616.9:616-053.2:616.24:616-085
616-085:616-053.2:616.24:616.9

23 Ayurveda system of medicine

61 (Ayurveda)

24 Siddha system of medicine

61 (Siddha)

25 Medical jurisprudence

61:340 (Bias)

32 Catalogue

321 Arrangement of Entries in the Classified Part of the Catalogue

The UDC prescription for the construction of multiple class numbers, wherever possible, for one and the same subject, is meant as an aid to the preparation of a main entry or a cross reference entry as the case may be, under each of the class numbers. These entries arranged in the increasing sequence of the ordinal value of their respective class numbers constitute the classified part of the catalogue. The Guide to UDC (2) has described this method of constructing the classified part of the catalogue as the "Multiple Entry System". This term has also been used to denote the catalogue constructed according to this method. The following arrangement of the class numbers will give an idea about the classified part constructed according to the Multiple Entry System:

SN	Class Number	Kind of Entry	SN of doc in Sec 31
1	(031)61(EGP)	Main Entry	1
2	(051)61(MJA)	-do-	2
3	(091)61(100)"195"	-do-	3
4	(091)61(410)"1939/1945"	-do-	4
5	"1939/1945"61(410)(091)	-do-	4
6	(410)61"1939/1945"(091)	-do-	4
7	(540)061.22:61(IMA)	-do-	6
8	(540)61.001.5"197"	-do-	7
9	061.22:61(540) IMA)	-do-	6
10	61:061.2(540)(IMA)	-do-	6
11	61:340(Bias)	-do-	25
12	61(031)(EGP)	-do-	1
13	61(051)(MJA)	-do-	2

333

SN	Class Number	Kind of Entry	SN of doc in Sec 31
14	61(092)	Main Entry	3
15	61(092)(Galen)	-do-	5
16	61(100)"195"(091)	-do-	3
17	61(410)"1939/1945"(091)	-do-	4
18	61(Ayurveda)	-do-	23
19	61 (Siddha)	-do-	24
20	61.001.5(540)"197"	-do-	7
21	611	-do-	8
22	611.12+	-do-	12
23	611.12+	-do-	13
24	611.2+	-do-	14
25	611.24+	Cross Reference entry	13
26	611.24+	Main Entry	15
27	611.24	-do-	16
28	612	-do-	9
29	612.17+	Cross Reference Entry	12
30	612.2+	-do-	14
31	612.24+	-do-	15
32	612.24	Main Entry	17
33	613.614(Difference)	-do-	11
34	614:613(Difference)	-do-	11
35	616	-do-	10
36	616-053.2:616.24:616.9:616-085	-do-	22
37	616-08:616.24	-do-	19
38	616-085:616-053.2:616.24:616.9	-do-	22
39	616-085:616.24	-do-	20
40	616-085:616.24:616.9	-do-	21
41	616.2+	Cross Reference Entry	14
42	616.24+	-do-	15
43	616.24	Main Entry	18
44	616.24:616-053.2:619.9:616-085	-do-	22
45	616.24:616-08	-do-	19
46	616.24:616-085	-do-	20
47	616.24:616.9:616-085	-do-	21
48	616.9:616-053.2:616.24:616-085	-do-	22
49	616.9:616.24:616-085	-do-	21
50	92:61	-do-	3
51	92:61(Galen)	-do-	5

334

322 Subject Index

UDC has prescribed the construction of the alphabetical subject index to the classified part of the catalogue, according to the procedure followed by the Decimal Classification in constructing its Relative Index. For the purpose of this paper, it is not necessary to furnish the subject index for the class numbers arranged in Sec 321. Therefore, it is not given here.

4 PROBLEM OF MULTIPLE ENTRY SYSTEM

The Guide to UDC (=Guide) (2) was published in 1963. It has worked out the economics of the Multiple Entry System. It has also evaluated the efficiency of this system. The findings of the study are quoted in the following section:

41 Disadvantages of Multiple Entry System

"The drawbacks to multiple entry ... are:

1 The impossibility of making anything but a selection of the possible permutations.

2 The lengthening of class numbers, which increases proportionately with the number of coloned elements.

3 The poor filing sequence which the use of the colon as a facet indicator entails.

4 The enlargement of the classified file, with the attendant problems of housing and filing it (5).

5 SOLUTION TO THE PROBLEM

51 Single Entry System

The main purpose of the Guide is to recommend a solution to the problem arising in the Multiple Entry System. The solution recommended by it has been described as the "Single Entry System" (3) The Single Entry System is primarily based on the following principles:

1 It is necessary to regard a particular sequence of the facets of a compound subject as the most helpful one.

2 It is economical to deem the class number corresponding to the most helpful sequence of the facets of a compound subject, as the unique class number for the subject concerned.

3 It is helpful to prepare only one main entry, or one cross reference entry, as the case may be, for each of the subjects enbodied in a document, under its unique class number for the classified part of the catalogue.

4 The alphabetical subject index to the classified part of the catalogue should be fully equipped to respond to a query for a specific subject using any facet-term, occurring in the name of subject concerned as the point-of-approach.

5 The alphabetical subject index made up of entries prepared under subject headings derived by Chain Procedure can equip it to respond to a query for a specific subject using any facet-term, occurring in the name of the subject concerned as the point-of-approach.

52 Impact of CC

It may be noted that the principles forming the foundation of the Single Entry System lead to a revolutionary deviation from the basic principles governing the design and development of UDC in its formative stage. From another point of view, these new principles form part of the set of principles governing the design and development of the Colon Classification (=CC) (7); and the features that distinguish CC from UDC are largely contributed by these principles.

This adoption of the CC-principles by UDC is a measure of the impact of CC on UDC. Simultaneously, it confirms the helpfulness of the CC-approach to library classification.

It may be noted here that the "flexibility" inherent in the design of UDC has made it practicable to adapt it helpfully in the context of so great a deviation from its original basic principles.

6 CLASSIFYING BY UDC ACCORDING TO THE GUIDE

60 Need for Principles for Classifying

The distinctive feature of the classified catalogue governs the basic operation of Classifying, as has been demonstrated in Sec 31. The classified catalogue recommended by the Guide is quite different from what originally UDC had in mind. Naturally, it calls for certain principles to govern the work of classifying. These principles form part of the set of principles constituting the basis for the

design and development of the scheme for classification. The Guide has provided some of the principles required for classifying (4). They are examined in the following sub-sections.

61 Principle of "Subject Factor Precede All Others"

The first principle in the Guide to UDC reads as follows: "Subject factors precede all others. ' 'Others' here mainly relate to forms of presentation of the information in the document ... ".

Each general scheme for classification has respected this principle in its design as well as in its rules for classifying. Only UDC according to the "Law of Local Variation" prescribed the option of treating a "form-facet" or a "language-facet" as the first facet, if necessary, in one of the class numbers for the Multiple Entry System. In the Single Entry System, this practice is ruled out. This has been a compulsory practice with CC from the very veginning.

62 Principle of "Consensus"

The principle of "consensus" in the Guide reads as follows:

"If a subject is traditionally studied along certain lines so that there is a strong expectation on the part of users to find certain aspects of the subject kept together, then this may determine citation order."

In the design and development of a scheme for

classification, this principle has been respected by each classificationist to the extent he has found it helpful. The design and development of CC has always been in conformity with a dynamic general theory of classification given in the Prolegomena to library classification (10). The Prolegomena introduced the concept of "Canonical Subject" defining it as follows: "Any traditional sub-division of a main subject, not derived on the basis of a definite characteristic". By this very definition, a canonical subject can occur only as an immediate subdivision of a main subject. This automatically satisfies the condition of bringing together all the compound subjects going with a particular canonical basic subject. The Prolegomena also says, "Mathematics, Physics, perhaps Engineering, Geology, and Philosophy form one group of main subjects calling for canonical subjects to be enumerated as the first step, before facet analysis can be applied for further classification. In these cases, the main subject is more like a bundle holding several canonical subjects. Tradition has found such bundles to be convenient ... " Evidently, the principle of "consensus" recommended by the Guide is in full agreement with the principle of "Canonical (traditional) Basic Subjects" given by the general theory of classification and implemented by CC.

It may be noted here that the intention of bringing together all the compound subjects having a particular facet, can be fulfilled only by

recognising the concerned facet to be either a basic facet, or the first isolate facet going with a particular basic facet. This work is gnerally left to the care of the classificationist; and he incorporates his decision while designing the scheme. The classifier enjoys very little autonomy in this respect. But in the case of UDC, the provision of "interpolation" (intercalation) makes scope for the classifier to enjoy sufficient autonomy even in this respect.

63 Principle of "Decreasing Concreteness"

The principle of decreasing concreteness in the Guide states: "More concrete elements are always cited before less concrete ones". The implication of this principle is very great. The Guide to UDC has not attempted any elaborate elucidation of this principle. It has simply referred to the Colon classification, Ed 6, 1961 where it is said to have been considerably developed.

The Guide has actually recommended the use of the "Postulate of Concreteness" for deciding the sequence of the isolate facets in the name of a compound subject. This postulate was first introduced in 1949 (9). Later on it was incorporated in Ed 2 of the Prolegomena (11) and in Ed 2 of the Elements of library classification (8). There appears to have been some failure in understanding of the content of this principle. But that is not important in the context of our universe of discourse. What is important is the recommendation of

this principle for deciding the sequence of the isolate facets in the name of a compound subject.

It may be noted here that the Postulate of Concreteness forms part of a set of integrally related postulates, and derives its proper significance when used alsong with the other postulates. In other words, it cannot be detached from this set and applied to serve any purpose. Therefore, the recommendation of the Postulate of Concreteness implies the recommendation of the whole set of integrally related set of postulates. This set of postulates consists of the following (13):

1 Postulate of Basic Facet.- Every compound subject has a Basic Facet.

2 Postulate of Fundamental Categories.- There are five and only five fundamental categories -- viz, Time, Space, Energy, Matter, and Personality.

3 Postulate of Isolate Facet.- Each isolate facet of a compound subject can be deemed to be a manifestation of one and only one of the five Fundamental Categories.

Note.- An isolate idea without an idea qualifying, it is a simple isolate idea. A simple isolate idea qualified by another idea gives rise to a compound isolate idea. A compound isolate idea is deemed to be a manifestation of the same fundamental category of which the simple isolate idea constituting it, is a manifestation. The qualifying idea is said to be a Qualifier. A Qualifier going with a compound

isolate, by itself, is not deemed to be a manifestation of any fundamental category. A Qualifier is to be suffixedto the entity qualified.

4 Postulate of Rounds for Energy.- The fundamental category "Energy" may manifest itself in one and the same subject, more than once. The first manifestation is taken to end Round 1 of the three fundamental categories -- Personality, Matter, and Energy. The second manifestation is taken to end Round 2, and so on.

5 Postulate for Round for Personality and Matter.- Each of the fundamental categories -- Personality and Matter may occur in Round 1, Round 2, and so on.

6 Postulate for Round for Space and Time.- Ordinarily any of the fundamental categories Space and Time may occur only in the last Round in subject.

7 Postulate of Level.- Any of the fundamental categories Personality and Matter may occur more than once in one and the same round within a subject; and similarly with Space and Time in the Last Round. The first manifestation of a fundamental category within a round will be said to be its Level 1 Facet in the Round. Its second manifestation within that Round will be said to be its Level 2 Facet in the Round, and so on.

8 Postulate of First Facet.- In a compound subject the Basic Facet should be the first facet.

9 Postulate of Concreteness.- The five fundamental categories fall in to the following sequence when arranged according to their decreasing concreteness.- P, M, E, S, T.

10 Postulate of Facet Sequence within a Round.- In any Round of facets of a Compound Subject in which each of any of the fundamental categories Personality, Matter, and Energy, occurs only once their sequence should be: Personality Facet, Matter Facet, and Energy Facet -- that is, in the decreasing sequence of their respective concreteness.

11 Postulate of Facet Sequence within the Last Round.- In the Last Round of facets of a compound subject, in which each of the fundamental categories other than Energy may occur, and occurs only once, the sequence of the facets should be: Personality Facet, Matter Facet, and Space Facet, and Time Facet -- that is, in the decreasing sequence of their respective concreteness.

The integral relationship of this set of postulates is obvious. Still it is worth noting that on the one side the Postulate of Concreteness becomes applicable only in the form of the Postulate of Facet Sequence within a Round, and the Postulate of Facet Sequence within the Last Round; and on the other, the concept of this postulate can not become operative unless the concepts behind all the other postulates enumerated before it (categories 1 to 8) are conceded.

This integrally related set of postulates enumerated above, form part of the general theory of classification. Any scheme for classification can make use of them in its design. CC has done this, and it has prescribed the Postulational Method of Classifying which is based on the same set of postulates.

Evidently, the Guide has recommended the adoption of the same Postulational Method of Classifying as adopted by CC on the basis of the general theory of classification.

64 Principle of "Purpose"

According to the Guide, "this is the principle of subordinating means to ends". This principle corresponds to the Actand-Action-Actor-Tool Principle of the general theory of classification (15). It states,

"If in a subject, facet B denotes action on facet A by Facet C, with facet D as the tool, then the four facets should be arranged in the sequence A B C D."

This principle again can be adopted by any scheme for classification in its design and development. It can also be adopted for classifying. CC has done this. And the Guide has recommended the adoption of the CC practice in classifying according to UDC.

65 Principle of "Dependence"

According to the Principle of Dependence, "If in a compound subject an element y is dependent on, or implies, another element x, then y is subordinated to x, and the citation order is xy, and not yx". This corresponds to the Wall-Picture Principle of the general theory of classification (14). It states "If two facets A and B of a compound subject are such that the concept behind B will not be operative unless the concept behind A is conceded, even as a mural picture is not possible unless the wall exists to draw upon, then the facet A should precede the facet B." This principle again can be adopted by any scheme for classification in its design and development. It can also be adopted for classifying. CC has done this. And the Guide has recommended the adoption of the CC practice in classifying according to UDC.

66 Standard Facet Formula

The Guide has recommended the following Standard Facet Formula:

"Whole thing -- kinds -- Parts -- Materials -- Properties -- Processes -- Operations -- Agents".

Evidently, this is a specific version of the Generalised Facet Structure forming part of the general theory of classification (16). It is in conformity with the set of postulates enumerated in Sec 63. Therefore, here again, the Guide has recommended the adoption of the CC practice.

67 Subject Index

We may also take note of the recommendation of the Guide in regard to the preparation of the subject index to the classified part of the catalogue. It recommends that the subject index should be made of entries prepared under the subject headings derived by Chain Procedure. In a classified catalogue based on CC, the subject index is always a chain index. Here again, the Guide has realised the effectiveness of a Chain Index.

7 CONCLUSION

71 Postulational Method of Classifying According to UDC

It is quite evident from Sec 6 above, that the Guide has recommended the adoption of the same Postulational Method of Classifying as prescribed by CC. The design and development of CC has been done consciously in conformity with the dynamic general theory of classification given in the Prolegomena to library classification. For this reason, classifying by CC is directly amenable to the Postulational Method. On the contrary, the design and development of UDC has not been done consciously in conformity with the dynamic general theory of classification. Therefore, classifying by UDC is not directly amenable to the Postulational Method. But UDC has the necessary "flexibility" for being adapted for this purpose, at the cost of some economy and effectiveness. If this economy and effectiveness is to be gained, much rethinking on the design and development of UDC

will be necessary. However, classifying according to the Postulational Method even with the present schedule of UDC will ensure a high degree of effectiveness. Here is an example demonstrating how the Postulational Method with the necessary and sufficient adjustment, can be applied to classifying according to UDC:

1 Expressive name-of-subject.- Treatment of the infectious diseases of lungs of children, in medicine.

2 Name-of-subject in kernel terms.- Treatment. Disease-infectious. Lung. Medicine-Child.

3 Analysed name-of-subject.- Treatment /Operation = Energy Isolate Facet/. Disease /Property = Matter Property Isolate Facet/- infectious /Qualifier to "Disease"/. Lung /Whole thing = Personality Isolate Facet/. Medicine /Basic Facet with which the compound subject is to go/ - Child /deemed to be a qualifier to "Medicine"; to treat the resulting subject "Child Medicine" as a Basic Subject by itself, for the purpose of bringing all the aspects of "Medicine" dealing with "Child" together; for it is assumed that it is a speciality (Specials Basic Subject) in "Medicine" and the majority of the readers having child medicine as their respective specific subject of interest, would prefer to have this arrangement/.

4 Transformed name-of-subject.- Medicine-Child /Basic facet/. Lung /Whole thing = Perso-

nality Isolate Facet_7. Disease - infectious /Property = Matter Property Isolate Facet_7. Treatment. /Operation = Energy Isolate Facet_7.

5 Name-of-Subject in Standard Term.- Assuming that the terms used in the schedule of UDC are standardised we can arrive at the following "Name-of-Subject in Standard Terms":

Medical sciences - Children /Basic Facet_7. Lungs /Whole thing = Personality Isolate Facet_7. Disease - infectious /Property = Matter Property Isolate Facet_7. Treatment /Operation = Energy Isolate Facet_7.

6 Name-of-Subject in Focal Numbers according to UDC:

61/3-053.2/(Basic Facet).
611.24 (Whole thing= Personality Isolate Facet).
616.9 (Property= Matter Property Isolate Facet).
616.085 (Operation= Energy Isolate Facet).

7 Class Number according to UDC.-

61/3-053.2/:611.24:616.9-085

Let us also take note of the steps 6 and 7 according to CC:

6 Name-of-Subject in Focal Numbers:
L9C (Basic Facet). 45 /Personality Facet_7. 42/Matter Property Facet_7. 6/Energy Facet_7.

7 Class Number according to CC:
L9C,45;42:6

The UDC Class Number is the closest approximation to the CC Class Number.

72 Annotation .

It is necessary to take note of the following points in regard to the conditions necessary to apply the method of classifying used in Sec 71 above:

1 The Basic Subjects are to be marked out in the Schedule of UDC. The criteria of recognising new Basic Subjects -- simple and compound -- are to be formulated.

2 Each of the facets in the name of a compound subject is an isolate facet -- simple or compound.

3 Wherever necessary, the number for an isolate facet is to be constructed by Subject Device.

4 In a simple isolate number, belonging to a compound class number, constructed by Subject Device, only the last digit or digit-group, depending upon the context, represents the isolate idea. The other digits preceding it are to be deemed as semantically empty. But they have to be retained in the class number because of the peculiarity of design of UDC. For example, in the isolate number 611.24, only 24 is semantically rich -- 2 representing "Respiratory System", and 4 representing "Lungs". But the digit-group 611 preceding 24 has no semantic significance in this context, though in the schedule it represents "Anatomy".

So also is the case with each component number of a compound isolate. Similar is the case with the second and further component numbers of a component number of a compound basic subject.

5 In the present structure of UDC, it is possible to construct two or more isolate numbers for the same isolate idea by subject device. To be consistent in practice, it is necessary to choose that one having the least ordinal value.

6 In the present structure of UDC, it may be possible to construct two or more class numbers for the same compound subject even following the Postulational Method of Classifying. To be consistent in practice, it is necessary to choose that one having the least number of digits.

7 To arrange the compound subjects going with a particular basic subject for the Single Entry System, the ordinal value of the digits has to be changed. This is an area for immediate research.

8 To achieve economy in the notational plane, and also in designing the schedule in a more effective way to meet the requirement of the Single Entry System, much rethinking about the design and development of the schedules of UDC is immediately necessary.

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CLASSIFICATION OF COMPLEX SUBJECTS IN CC AND UDC.

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The general theory of library classification has recognised different varieties of complex subjects involving different variety and levels of phase relation. In order to give coextensive class number to each complex subject, CC has provided for different indicator digits, each distinctively indicating the variety and level of phase relation. UDC, on the other hand, has not provided distinctive indicator digit for phase relation, although the relation sign " : " (colon) may be used for the construction of class number for a complex subject. The resulting difference in the sequence of complex subjects is discussed. The need for and advantage of recognising intra-chain phase relation is also discussed.

1 INTRODUCTION

11 Kinds of Subject

The General Theory of Library Classification (12) recognises three kinds of subjects in the Universe of subjects:

1 Basic Subject -- that is, a Subject without any Isolate Idea;

2= Compound Subject -- that is, a Subject made up of a Basic Subject and one or more Isolate Ideas; and

3 Complex Subject -- that is, a Subject involving two or more Basic Subjects or Compound Subjects in Phase Relation.

12 Incidence of Complex Subject

The incidence of Complex Subjects at the book level is comparatively fewerthan that of Compound Subjects. In a survey made in 1969 (6) it was found that out of 16,000 documents, about 125 documents involved Complex Subjects. It was also found that the incidence of Complex Subjects in article level is very small. However, a scheme for library classification should provide for the unique representation of each and every Complex Subject in the Universe of Subjects.

2 KINDS OF COMPLEX SUBJECT

21 Idea Plane

In the General Theory of Library Classification six different varieties of Phase Relation have been recognised. These are:

1 General Phase Relation;
2 Bias Phase Relation;
3 Comparison Phase Relation;
4 Difference Phase Relation;
5 Tool Phase Relation; and
6 Influence Phase Relation.

22 Notational Plane

220 Coextensive Representation of Complex Subjects

A scheme for library classification aiming at coextensive classification of different varieties of Complex Subject should recognise these different

353

varieties of Phase Relation and provide for their representation in the respective class numbers. In this paper, the provision in the Notational Plane for indication of Phase Relation in the current version of the Colon Classification (CC) (8) and the Universal Decimal Classification (UDC) (4) is discussed.

221 Colon Classification

The current version of CC has made provision for the following:

1 The Indicator digit " & " (ampersand) to indicate Phase Relation in the Class Number;

2 A Roman small letter to indicate the varieties of Phase Relation (See table in Sec 321).

222 Universal Decimal Classification

The current version of UDC provides for

1 The digit " : " (colon) to indicate Phase Relation in the class number for a Complex Subject. However, the digit " : " (colon) is also used as an Indicator Digit for Facet and for other kinds of relations (2,18). Further, there is no provision for indicating the different varieties of Phase Relation. However, Donker Duyvis, the late Secretary-General of FID, had suggested in 1958 the following indicator digits for different varieties of Phase Relation (5).

Kind of Relation suggested by Donker Duyvis	Digit	Kind of Relation recognised in the theory
Mutually Passive relationship	:.:	General, Comparison, and Difference
Mutually Active relationship	::	Influence
Passive-Active relationship	:.	Tool
Active-Passive relationship	.:	Bias

The FID/CCC, which is in charge of the development of UDC, has not so far implemented this suggestion.

3 LEVELS OF COMPLEX SUBJECT

31 Idea Plane

A Phase Relation may occur between:

1 Two Basic Subjects/Compound Subjects;

2 Two isolate ideas enumerated in the same schedule, and forming a facet of a Compound Subject. This is denoted by the term 'Complex Facet'; and

3 Two coordinate array isolates occurring in one and the same array in one and the same schedule, other than the array of order 1. This is denoted by the term 'Complex Array Isolate'.

We shall denote each of the above categories of Phase Relation by the term 'Level of Phase Relation'. Thus, we have the following three levels of Phase Relation:

1 Inter-Subject;

2 Intra-Schedule; and

3 Intra-Array.

32 Notational Plane

321 CC

The following table gives the different digits used by CC to represent different varieties of Phase Relation in different Levels:

Intra-array	Intra-schedule	Inter-subject	Variety of relation
t	j	a	General
u	k	b	Bias
v	m	c	Comparison
w	n	d	Difference
x	p	e	Tool
y	r	g	Influencing

322 UDC

UDC has not provided any distinctive digit to indicate the different Levels of Phase Relation.

33 Advantage of Recognising Levels of Phase Relation

The Levels of Phase Relation may be taken to indicate the difference in the strength of bond between the phases. Further, CC has effected economy in the length of class number for complex subject, by providing distinct digits for the representing the different levels of phase relation in the class number. The following examples illustrate the saving of digits in the CC numbers.

Complex Subject	Level of Phase Relation	Class Number	N of Digits
1 Comparison between UDC and CC	Inter-Subject	2;51M9&c2;51N3	14
	Intra-Schedule	2;51M9&m51N3	12
	Intra-Array	2;51M9&vN3	10
2 Influence of Tamil literature on Malayalam literature	Inter-Subject	0,32&g0,31	10
	Intra-Schedule	0,32&r31	8
	Intra-Array	0,32&y1	7
3 Economic relation between Tamil Nadu and Mysore	Inter-Subject	X.4411&aX.4413	14
	Intra-Schedule	X.4411&k4413	12
	Intra-Array	X.4411&u3	9

4 SEQUENCE OF COMPLEX SUBJECTS

41 Position of Complex Subject

It is helpful to arrange Complex Subjects going with a Host Subject -- Basic or Compound -- earlier to the Compound Subjects going with the same Host Subject. For, a Complex Subject is said to be more general than a Compound Subject going with the same Host Subject. In order to secure this in the Notational Plame, CC has prescribed a lower ordinal value to the digit "&" (ampersand) than any of the Facet Indicators -- that is, it has an ordinal value less than ' (single inverted comma). Similarly, UDC has prescribed for the digit " : " (colon) an ordinal value greater than that of " / " (stroke),

(3), but lower than that of "[ ]" (square brackets). However, UDC cannot distinguish between a Complex Subject and a Compound Subject in its Class Number. Therefore, there will be a mix up of these two kinds of subjects.

42 Sequence among Complex Subjects in CC

The following examples show the sequence of Complex Subjects involving different varieties of Phase Relation according to CC.

SN	CC Number	Subject
1	B&aBT	Relation between Mathematics and Statistical Calculus
2	B&aC	Relation between Mathematics and Physics
3	B&aX	Relation between Mathematics and Economics
4	B&b8	Mathematics for Managers
5	B&bC	Mathematics for Physicists
6	B&bD	Mathematics for Engineers
7	B&bLY1	Mathematics for Nurses
8	B&bX	Mathematics for Economists
9	B&cBT	Comparison between Mathematics and Statistical Calculus
10	B&cC	Comparison between Mathematics and Physics
11	B&cX	Comparison between Mathematics and Economics
12	B&dBTT	Difference between Mathematics and Operations Research
13	B&dC	Difference between Mathematics and Physics
14	B&dR$_1$	Difference between Mathematics and Logic

SN	CC Number	Subject
15	B&eR	Application of Philosophy in Mathematics
16	B&eS	Application of Psychology in Mathematics
17	B&gC	Influence of Phvsics on Mathematics
18	B&gR1	Influence of Logic on Mathematics

In all the examples given above, Mathematics is is Phase 1, and Phase 2 consists of different subjects. The arrangement of the different Complex Subjects is by the variety of relation involved in their formation. In other words, all "General Phase Relations" with Mathematics as Phase 1 are arranged together. Similarly Bias, Comparison, Difference, etc.

43 Sequence among Complex Subjects in UDC

The same examples given in Sec 42 will get arranged in the following sequence according to UDC.

SN	UDC Number	Subject
1	51:1	Application of Philosophy in Mathematics
2	51:159.9	Application of Psychology in Mathematics
3	51:16	Difference between Mathematics and Logic
4	51:16	Influence of Logic on Mathematics
5	51:311	Relation between Mathematics and Statistical Calculus
6	51:311	Comparison between Mathematics and Statistical Calculus

SN	UDC Number	Subject
7	51:519.28	Difference between Mathematics and Operations Research
8	51:33	Relation between Mathematics and Economics
9	51:33	Mathematics for Economics
10	51:33	Comparison between Mathematics and Economics
11	51:53	Relation between Mathematics and Physics
12	51:53	Mathematics for Physicists
13	51:53	Comparison between Mathematics and Physics
14	51:53	Difference between Mathematics and Physics
15	51:53	Influence of Physics on Mathematics
16	51:616-083	Mathematics for Nurses
17	51:62	Mathematics for Engineers
18	51:65	Mathematics for Managers

As may be seen, UDC does not give coextensive Class Number to each of the different varieties of Complex Subjects. In other words, one and the same Class Number represents two or more subjects. But, it may be noted that the Complex Subjects involving one and the same subject in both Phases get arranged together. Thus, all varieties of Complex Subjects involving Mathematics as Phase 1 and Physics as Phase 2 get arranged together without being separated by any other Complex Subject having Mathematics as Phase 1 and any other subject as Phase 2. Further, if the suggestion

given by Donker Duyvis is adopted and the value for the Indicator Digits is helpfully fixed, the homonyms in UDC can be resolved to a certain extent.

44 A Moot Question

Whether it is more helpful to arrange all Complex Subjects by the subjects involved in the two Phases irrespective of the variety of relation, or arrange them according to Phase 1 and then by the variety of relation (1), was the question posed by H C Jain, while discussing the arrangement of Complex Subjects at the DRTC Seminar (7) (1969).

The argument in favour of the first grouping is as follows: In general, it has been observed that if two subjects get interrelated by the mode of Loose Assemblage, to form a Complex Subject, there is a possibility of a steady growth in the strength of bond of the relationship between the components. In other words, a subject having a Passive General Phase Relation may later give rise to Bias Phase Relation, Tool Phase Relation, and Influence Phase Relation, in that sequence. This may ultimately culminate in forming a new Main Subject, such as a Fused Main Subject. Biochemistry is an example of this (6,10). Therefore, it is helpful if all the different varieties of Complex Subjects, formed due to the difference in the strength of bond between the same two components, are placed together.

361

The argument in favour of the arrangement of the Complex Subjects by the variety of Phase Relation is as follows: The Principle of Increasing Concreteness (11) suggests that a subject in Phase 1 having a General Phase Relation with another subject is less concrete than the one having a Bias Phase Relation with any other subject. In other words, arrangement according to Increasing Concreteness, of the different varieties of Phase Relations, is as follows:

General	Difference
Bias	Tool
Comparison	Influence

Therefore, it appears that the Canon of Helpful Sequence and the Canon for Filiatory Sequence are satisfied better if all Complex Subjects having different varieties of Phase Relations between one and the same set of component subjects are placed together.

5 INTRA-CHAIN PHASE RELATION

51 Need for the Recognition of Intra-Chain Phase

Array and Chain are complementary concepts. Therefore, Law of Symmetry (14) and Law of Impartiality (13) suggest for the provision of a new level of phase relation -- namely, Intra-chain Phase Relation.

52 Support by the Theory of Strength of Bond

"Relation between Mathematics and Physics" is inter-subject phase relation. "Influence of

Economics of India on the Economics of China" is intra-array phase relation. "Influence of Economics of India on the Economics of Mysore" is at present treated as Intra-schedule phase relation in the Class Number. But actually, the relation is between two links in the chain. The Class Number would not coextensively represent the strength of bond between two phases in this subject, unless there is an indicator digit to indicate the Intra-chain phase relation.

53 Digits for Indicating Intra-Chain Phase Relation

531 Problem in Choice of Indicator Digits

As stated earlier, in CC each of the different levels and varieties of phase relation has a distinct indicator digit. At present, there are 18 phase relation indicators. All these are Roman small letters. Since i, o and l cannot be used in the base of CC notational system (8), we are left with only 5 more Roman small letters to indicate any new phase relation. However, if Intra-chain relation is taken as another level of Phase Relation, we will need six Roman small letters to indicate each of the six varieties of phase relation.

532 Reallocation of Indicator Digits

The situation can be resolved by making a reallocation of indicator digits. In doing this, it is suggested that one of the varieties of Phase relation -- namely "difference phase relation" -- may be treated as a subordinate variety

of the "Comparison Phase Relation". Then, we may indicate this in the Class Number with two-digited indicator digits. This will not effect the economy in notation, as it has been found that the incidence of "Difference Phase Relation" is relatively very small (7). Thus, the re-allocation of indicator digits so as to accommodate 24 different varieties of phase relation is as shown in the following table.

533 Proposed Allocation of Indicator Digits

Variety of Phase Relation	Levels of Phase Relation			
	Inter-Subject	Intra-Schedule	Intra-Array	Intra-Chain
General	a	h	p	u
Bias	b	j	q	v
Comparison	c	k	r	w
Difference	cd	kd	rs	wd
Tool	e	m	s	x
Influence	g	n	t	y

54 Helpful Sequence of Complex Subjects

The indication of the Intra-chain phase relation in the Class Number secures a sequence

of complex subjects, satisfying the strength of bond theory (9,10) and the principles for helpful sequence (17), as indicated in the following examples:

2;51&gR4	Influence of logic on library classification
2;51&n7	Influence of reference service on library classification
2;51&t5	Influence of cataloguing on library classification
2;51&yN3	Influence of Colon Classification on library classification

55 Economy in Notation

The following table presents data on the saving of digits in the length of Class Numbers effected by recognition of Intra-chain phase relation.

SN	Complex Subject	Level of Phase Relation	Class Number	N of digits	N of digits saved
1	Influence of Colon Classification on Library Classification	Inter-Subject	2;51&g2;51N3	12	
		Intra-Schedule	2;51&n51N3	10	2
		Intra-Chain	2;51&yN3	8	4
2	Comparison between Sanskrit Language and Hindi Language	Inter-Subject	P,15&cP,152	11	
		Intra-Schedule	P,15&k152	9	2
		Intra-Chain	P,15&w2	7	4
3	Influence of the economic resources of Madras district on that of Tamil Nadu	Inter-Subject	X2.4411&g X2.441111	18	
			X2.4411&n441111	15	3
			X2.4411&y11	11	7

56 Phase Relation between a Lower Link and an Upper Link in the Same Chain

Consider a complex subject, such as "Economics of the Mysore State influenced by the Economics of India". This subject involves Intra-Chain Phase Relation. But the Phase 1 -- that is Influenced Phase -- consists of the isolate idea "Mysore" which is a link of higher order in the chain than the isolate idea "India". The Class Number for this subject will be X.4413&y44. If the subject was taken as Intra-schedule Phase Relation, then the Class Number would be X.4413&n44. As it can be seen, there is no saving in the number of digits in the Class Number representing Intra-chain phase relation. But, however, it coextensively represents the inter-relationship between the two component phases. Therefore, it is helpful to represent this case as Intra-chain phase relation in the Class Number.

57 Telescoping in Array and Intra-Chain Phase Relation

Consider the complex subject "Influence of the geography of the World on that of Europe". The Phase Relation involved is Intra-chain phase relation; for, "Europe" is a subdivision of "World". But in the schedule of space isolates in CC, these two concepts have been treated as if they are coordinate ideas belonging to one and the same array -- that is, a telescoped array. Since they belong to Array of Order 1 in Space Isolates schedule, they have to be deemed as Intra-schedule

phase relation -- that is, the Class Number would be U.1&n4. Thus, although the bond between the two component phases in the complex subject under consideration is Chain bond in the idea plane, the "telescoping in array" has converted it into Intra-schedule phase relation. This anamoly is largely due to the concept of "Telescoping" which violates the Canon of Hierarchy (16) in order to secure economy in the length of Class Number (15).

58 Compound Isolate and Intra-Chain Phase relation

Consider the following subjects:

1 Comparison of the technology of glasses for goggles and of red coloured glass for goggles.

2 Comparison of technology of red coloured glass and pink coloured glass for goggles.

These two subjects contain complex isolates involving comparison of phase relation between two compound isolate ideas. The hierarchical relation between these isolates is chain relation. Therefore, the level of phase relation is Intra-chain phase relation. Therefore, the following CC numbers represent them respectively:

1 F8,445-QL4&wcR83

2 F8,445-QL4-cR83&w2

Consider the following subject involving Intra-chain phase relation:

"Comparison of technology of glasses for goggles and red coloured ultra-violet proof glass for goggles". The CC number will be "F8,44-QL4&wcR83-cR7G". This class number can become homonyms. For, the speciator "Ultra-violet proof" may be taken as speciator either to Phase 1 or Phase 2. However, this problem is not restricted only to the recognition of Intra-chain phase relation. It is likely to crop up even in the case of Intra-schedule and Intra-array phase relation. In general, the speciators following a complex isolate idea involving phase relation between two compound isolates, give rise to homonym, unless some indication is built into the class number.

6 ACKNOWLEDGMENT

This paper is a sequel to the discussions held in the Series of Colloquia on "Complex Subjects" in DRTC in 1971. We are thankful to all the participants who have thrown some light on the problem.

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13 Sec 51 --. --. Chap LD.

14 Sec 51 --. --. Chap DE.

15 Sec 57 --. --. Chap DF.

16 Sec 57 --. --. Chap JE.

17 Sec 54 --. --. Part F.

18 Sec 222 SEETHARAMA (S) and GOPINATH (M A). Classification of books on "Disease" in Medicine: A comparative study of CC and UDC numbers. (Annual Seminar, (DRTC); 9;1971; Paper N , Sec 231).

370

DRTC Seminar (9)(1971). Paper CD.

FUSED MAIN SUBJECTS.

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The helpfulness of dividing the universe of subjects, in the first instance, into a few chunks called Main Subjects, is indicated. The need for a further division of some of the Main Subjects into a few non-Main Basic Subjects, is also mentioned. The principles used by Colon Classification in arranging the Main Subjects in a helpful sequence, are referred to. The concept of Fused Main Subject and its formation are discussed with illustrative examples from Colon Classification, Ed 7. Guiding Principles for deeming a new Fused Main Subject as an adjunct to one or the other of the fusing Main Subjects are formulated. The application of these principles for determining the position of new Fused Main Subjects of the future is illustrated. The basis for the guiding principles and for the pattern of representation of the sequence of the phases in a complex subject according to the general theory of library classification, are discussed. The resolution of a homonym by the concept of Fused Main Subject, in representing subjects is pointed out. The accomodation of Fused Main Subjects in UDC is discussed. Two problems for investigation are mentioned.

Abbreviations Used:

(BS) = Basic Subject

(MS) = Main Subject

1 TERMINOLOGY

A few of the specialised terms used in this paper are defined in the succeeding sections. Definitions of other specialised terms can be found in the Prolegomena (2).

11 Subject

An organised or systematised body of ideas, whose extension and intension are likely to fall coherently within the field of interest and comfortably within the intellectual competence and the field of inevitable specialisation of a normal person.

12 Isolate

Any idea or idea-complex fit to form a component of a subject.

13 Basic Subject

A subject without any isolate as a component.

14 Compound Subject

A subject with a Basic Subject and one or more isolates as components.

15 Complex Subject

A subject formed by coupling two or more subjects expounding, or on the basis of, some relation between them.

2 DIVISION OF UNIVERSE OF SUBJECTS INTO FIELDS OF SPECIALISATION

21 Consequence of the Growth of the Universe of Subjects

The Universe of subjects is ever-growing. New ideas and combination of new ideas -- that is, subjects -- are emerging from time to time. At some stage or other in its development the existence of a very large number and variety of subjects in the universe of subjects, would have made it necessary to divide the "field of work" among scholars in such a way that each division contained a more or less homogeneous group of subjects fit to form a convenient field of specialisation among different groups of scholars.

22 Classificationist Follows Suit

The classificationist usually finds it convenient to follow suit and group the subjects into a few "fields of specialisation". The grouping follows, more or less, the general pattern of division of the universe of subjects by scholars into homogenous groups of subjects fit for specialisation. Each chunk of the universe of subjects into which such a homogeneous group of subjects may be deemed to fall, is called a Main Basic Subject (or Main Subject). The (MS) are expected to be mutually exclusive and totally exhaustive of the universe of subjects.

23 Further Division

As the universe of subjects develops further,

a stage is reached when the number and variety of subjects going with a (MS) taken as a whole may be found to be too many to form a convenient field of specialisation. A further division of the field of work among the specialists may be found helpful. The classificationist usually finds it convenient to follow suit and to group the subjects going with the (MS) concerned, into a few smaller groups of homogeneous subjects. This grouping may parallel the division of the field of work among the scholars or specialists. Each such smaller chunk of the universe of subjects (within the larger chunk -- that is, (MS)) into which a smaller group of homogeneous subjects may be conveniently deemed to fall, is called a Non-Main Basic Subject. The Non-Main (BS) are expected to be mutually exclusive and totally exhaustive of the subjects going with the (MS) concerned.

24 Postulate of Basic Subject

A postulate of the General Theory of Library Classification recommends that each subject be deemed to go with a (BS) -- a (MS) or a Non-Main (BS). A helpful result of this prescription is that the subjects get marked off and grouped into more or less homogenous set of compound subjects going with a (BS). And each such group of subjects can form a convenient field of specialisation of a normal intellectual.

3 SEQUENCE OF BASIC SUBJECTS

31 Main Subjects

The number of (MS) is not too large. Therefore, most of the schemes for classification succeed in arranging them on the basis of some principle, whether explicitly stated or not. The resulting sequence is more or less helpful in most cases. Therefore, we may take the (MS) and their sequence to be postulated by the scheme prescribing them.

32 Non-Main Basic Subjects

The number of Non-Main (BS) into which a (MS) may be divided is not usually too large. Therefore, most of the schemes for classification succeed in arranging the Non-Main (BS) going with a (MS), on the basis of some principle -- whether explicitly stated or not. The resulting sequence is more or less helpful in most cases. Therefore, we may take the Non-Main (BS) and their sequence to be postulated by the scheme prescribing them.

33 In Colon Classification

331 Traditional (MS)

CC divides the universe of subjects as a whole, in the first instance, into three broad groups -- namely, Natural sciences, Humanities, and Social sciences. These three groups are arranged in the sequence mentioned, and consist of the "Traditional (MS)". For the purpose of this paper, when we consider the sequence of a particular (MS) we shall

take along with it, its Adjunct (MS) -- as for example, the Adjunct (MS) "GWC Biophysics" and "GX Biochemistry" being taken along with the traditional (MS) "Biology"; similarly, the Adjunct (MS) "WX Geopolitics" being taken along with the traditional (MS) "W Political Science".

332 Pure-Applied Sequence

Among the (MS) in the Natural sciences group, an "applied discipline" follows the "pure discipline" on which the former is predominantly based. For example, "D Engineering" follows "C Physics"; "F Technology" follows "E Chemistry", "J Agriculture" follows "I Botany", and "KX Animal husbandry" and "L Medicine" follow "K Zoology". Among the (MS) in the Social sciences group also a similar sequence of "Pure discipline-followed by "Applied discipline" is discernible. For example, "XX Industrial economics" follows "X Economics" and "YX Social work" follows "Y Sociology".

333 Principle of Increasing Concreteness

The (MS) covering the pure disciplines in the Natural sciences group are arranged among themselves in the sequence of "increasing concreteness" from "B Mathematics" to "△ Spiritual experience and mysticism". Thus:

B	Mathematics	G	Biology
C	Physics	H	Geology
E	Chemistry	I	Botany
K	Zoology	△	Spiritual experience and mysticism

334 Principle of Increasing Artificiality

The (MS) in the Humanities and Social sciences groups taken together are arranged in the sequence of "increasing artificiality" from "△ Spiritual experience and mysticism" to "Z Law". Thus,

△	Spiritual experience and mysticism	T	Education
		U	Geography
N	Fine arts	V	History
O	Literature	W	Political science
P	Linguistics	X	Economics
Q	Religion	Y	Sociology
R	Philosophy	X	Law
S	Psychology		

It will be noted that, looked at from one angle "△ Spiritual experience and mysticism" is the most concrete discipline and looked at from another angle, it is the most natural (1).

335 Partial Comprehension

A Partial Comprehension is interpolated in the schedule of (MS) in the appropriate position -- immediately preceding the first (MS) it comprehends. For example, "Social sciences" comprehends "T Education", "U Geography", "V History", "W Political science", "X Economics", "Y Sociology" and "Z Law". Therefore, the Partial Comprehension "SZ Social sciences" is placed immediately earlier to "T Education".

336 Other (MS)

There is a group of (MS) placed between

"z Generalia" and "9Z Sciences". These are not considered in this paper.

4 PROBLEM OF INTERPOLATION

41 Preserving Helpful Sequence

The development of the universe of subjects is accelerating. The emergence of new subjects necessitates the enumeration of new Basic Subjects -- (MS) and Non-Main (BS) -- with which the new subjects may be helpfully deemed to go. As mentioned earlier, to begin with, the postulated sequence of (MS) given by the scheme for classification concerned, may be accepted as helpful. When a new (MS) is formed, it becomes necessary to interpolate it in the existing schedule of (MS). The position of the new (MS) should be such as to preserve the helpful sequence among the (MS). For, it will, in turn, help to preserve the APUPA (Alien-, Penumbral-, Umbral-, Penumbral-, Alien Subjects) pattern of arrangement among the compound subjects going with all the (BS).

42 Varieties of (MS)

It is helpful to study

1 The mode of formation of (MS); and

2 The way in which the subjects deemed to go with a (MS) have been structured and represented prior to the formation of the new (MS).

In CC, Ed 7, several new (MS) have been added. Some of these have been formed by "Fusion" while some others have been formed by "Distillation".

In this paper we shall consider only Fused (MS) -- that is, (MS) formed by Fusion.

5 FUSED MAIN SUBJECT

51 Interdisciplinary Research

An important feature of the organisation for research in recent years is team research becoming predominant as compared to the solo-research of the earlier days. In team research specialists from different subject fields may be brought together and their work so coordinated as to be conducive to higher productivity of new ideas and achievement of the objectives of the project. A point of significance in team research is the inter-disciplinary character of the ideas emerging from it.

52 Association of New Idea

In the initial stages, the classificationist and the classifier may deem such a new idea to go with one of the host (MS) with which the field of specialisation of one or the other of the members of the team, may be deemed to go. Let us call it the Parent (MS). In due course, there will be an increase in the number of such new ideas of an interdisciplinary character. The classificationist may then realise that

1 The new ideas themselves are capable of attracting a group of specialists to work on them -- that is, these new ideas by themselves, taken as a whole, may form a field of specialisation; and

2 That it is unhelpful to continue to deem the

new ideas as going with one or the other of the parent (MS) only.

53 Formation of a New Main Subject

At this stage, the classificationist may find it convenient to deem the new ideas to go with a new (MS). The new (MS) may be deemed to be a combination of the Parent $(MS)_s$. Such a (MS) is called a Fused (MS). The compound subjects going with this (MS) may require the use of isolates peculiar to itself, in addition to the schedules of isolates going with each of the Parent (MS).

54 Move Towards Fused (MS)

Table 1 gives a list of the Fused (MS) enumerated in CC, Ed 7 (1972). Col d to Col f mention the way in which the subject was represented in terms of mode of formation of subjects prior to its being deemed as a subject going with a new Fused (MS). The UDC number is given in col g. The following UDC schedules were used:

1 UDC. Abridged English Edition. Ed 3. BS 1000A:1961.
2 UDC 159.9 Psychology.
3 UDC 3/308 Social sciences. Sociology. Sociography.
4 UDC 31 Statistics. 1000 [31]: 1970.
5 Special - Subject tables for Geology, Surveying, Cartography, and related branches of science and Engineering. 1970.

380

541 Table 1. Fused Main Subjects

SN	CC Ed 7		Representation of Subject/Period			U D C
	Class Number	Subject/ Year	Complex Subject (Loose Assemblage)	Compound Subject (Lamination)	Non-Main Basic Subject (Fission)	
a	b	c	d	e	f	g
1	2T	Librametry (1970)	Library Science application of Statistical Calculus (1933-69)			02:311
2	BYC	Astrophysics (1969)		Astronomy:Astrophysics (1939-69)		523.03
3	BYE	Astrochemistry(1970)	Astronomy application of Chemistry (1933-69)			523.04
4	BYG	Astrobiology (1970)	Astronomy application of Biology (1933-69)			523.07

a	b	c	d	e	f	g
5	DT	Engineering Statistics (1970)	Engineering application of Statistics (1933)			62:311
6	DV	Engineering Cybernetics (1970)	Engineering application of Cybernetics (1933-69)			62:007
7	EX	Chemical Engineering (1968)	Engineering bias to Technology (1933-50) Technology application of Engineering (1950-67)		Engineering in Chemical Environment (1968-69)	66.0
8	GWB	Biomechanics (1969)	Biology application of Mechanics (1933-68)			577.3
9	GWC	Biophysics (1969)	Biology application of Physics (1933-68)			577.3

a	b	c	d	e	f	g
10	GX	Biochemistry (1967)	Biology application of Chemistry (1933-51)	Chemistry (BS):Biochemistry (E) (1952-56)	Bio-chemistry (1957-66)	577.1
11	GXT	Biometry (1970)	Biology application of Statistical Calculus (1933-69)			578.087
12	GXV	Biocybernetics (1970)	Biology application of Cybernetics (1933-69)			574:007
13	HV	Geophysics (1968)	Geology application of Physics (1933-67)			550.3
14	HVT	Geochemistry (1968)	Geology application of Chemistry (1933-67)			550.4
15	JT	Agrometry (1970)	Agriculture application of Statistical Calculus (1933-69)			63:311

a	b	c	d	e	f	g
16	LUD	Medical technology (1969)	Medicine application of Engineering (1933-68)			615.47
17	LYT	Medicometry (1969)	Medicine application of Statistical Calculus (1933-68)			61:311
18	LYV	Medical Cybernetics (1970)	Medicine application of Cybernetics (1933-69)			61:007
19	LYX	Medical jurisprudence (1969)	Medicine bias to Jurisprudence (1933-68)			340.6
20	PT	Linguametry (1970)	Linguistics application of Statistical Calculus (1933-69)			41:311

542 Annotation

1 Out of the 30 Fused (MS), all except two — Astrophysics and Psychometry -- were represented as Phase Relation between subjects going with two different (MS), which are now taken to be the fusing (MS).

2 In the case of Biochemistry, the subject has been successively represented as Phase Relation, Lamination, and Fission -- thus, representing a progressive increase in the strength of bond between Chemistry and Biology, finally giving rise to the fused (MS) "Biochemistry".

3 Nine out of the 30 fusions are accounted for by the fusion of one of the traditional (MS) and Statistical Calculus.

4 Eight out of the 30 fusions are accounted for by the fusion of one of the traditional (MS) and Cybernetics.

5 There are 18 Fused (MS) from the Natural sciences.

51 Of these, 7 are of the variety mentioned in categories 3 and 4;

52 There is only one fusion of a (MS) from the Natural Sciences with one from the Social sciences -- that is, Medical Jurisprudence; and

53 Out of the remaining 10, 8 are accounted for by a fusion of a (MS) with either Physics, or Chemistry, or Biology.

6 There are 11 fused (MS) in Humanities and Social sciences.

387

61 Of these, 10 are of the varieties mentioned in categories 3 and 4.

6 INFERENCE

61 Guiding Principle

From a study of the placing of the new Fused (MS) in the schedule of (MS) in CC (See Table 1 in Sec 541), it is possible to formulate the following guidelines for determining as to which of the existing (MS), the new Fused (MS) should be an adjunct -- that is, has greater filiation.

1 If the subjects going with a new Fused (MS) has been represented, earlier to the fusion, as a Complex Subject involving either a bias, or application, or influence phase relation, between the two fusing (MS), then the fused (MS) can be deemed to be an Adjunct (MS) to the (MS) of the subjects in Phase 1.

2 If the subjects going with a new Fused (MS) has been represented, earlier to the fusion, as a Compound Subject, then the fused (MS) can be deemed to be an Adjunct (MS) to the (MS) with which the Compound Subject was deemed to go.

62 Application of Principle

Table 2 in Sec 621 mentions a few subjects which may, in due course, lead to or demand the formation of new Fused (MS). A brief definition and scope of each subject (Col b), representation of the subject at present (Col c), indication as to which of the (MS) the new Fused (MS) will be an adjunct by applying the principles mentioned in Sec 61(Col d), and UDC number are given. The sequence of the components in the UDC number has been determined by the Principles for Helpful Sequence.

a	b	c	d	e	f	g
21	PV	Linguistic Cybernetics (1970)	Linguistics application of Cybernetics (1933-69)			41:007
22	ST	Psychometry (1970)		Psychology (BS):Psychometry (E) (1933-69)		159.938.3
23	SV	Psycho-cybernetics (1970)	Psychology application of Cybernetics (1933-69)			159.9:007
24	TT	Educametry (1970)	Education application of Statistical Calculus (1933-69)			37:311
25	TV	Educational Cybernetics (1970)	Education application of Cybernetics (1933-69)			37:007

a	b	c	d	e	f	g
26	WX	Geopolitics (1969)	Political science influenced by Geography (1933-68)			327.39
27	XT	Econometrics (1970)	Economics application of Statistical Calculus (1933-69)			330.115
28	XV	Economico-Cybernetics (1970)	Economics application of Cybernetics (1933-69)			33:007
29	YT	Sociometry (1970)	Sociology application of Statistical Calculus (1933-69)			301:311
30	YV	Sociocybernetics (1970)	Sociology application of Cybernetics (1933-69)			301:007

SN	Name and scope of subject/ Example of book	Representation as a (BS) only, or Complex Subject or Compound Subject	New fused (MS) will be adjunct to	U D C
a	b	c	d	e
1	ERGONOMICS Use of the principles of human physiology and psychology in the organisation of work so as to increase productivity. 1 MORRELL (K F A). Ergonomics. 1969. 2 EDHOLM (O G). Biology of work. 1967.	8;Y&eL;3 Management science; Personnel work application of Medicine, Physiology and 8;Y&eS Management science; Personnel work application of Psychology	8 Management Science	65.015
2	SPACE BIOLOGY Study of living organisms in space environment. 1 WUNDER (C C). Life into space. 1965.	G9UQ91 Biology in space environment.	G Biology	523.07

a	b	c	d	e
3	BIOCLIMATOLOGY Effect of natural environment on living organisms with emphasis on the interplay between disciplines such as meteorology and physiology. 1 SARGENT (P) and STONE (R G), Ed. Recent studies in bioclimatology. 1954. (Metero monogram 3.8). 2 LITCH (S), Ed. Medical climatology. 1964. 3 BECKER (F) and others. Human biometeorology. 1964.	G&gHV81 Biology influenced by Meteorology.	G Biology	551.586
4	PSYCHOSOMATIC MEDICINE Interaction between mind and body in health and disease and the role psychological factors in the genesis of organic disease and the reaction of individual personality to such disease. 1 JONES (A) and FREYBERGER (H), Ed. Advances in psychosomatic medicine. 1961.	L;49L Medicine; Psychosomatic Disease	L Medicine	616.89: 616

a	b	c	d	e
	2 MANHOLD (J H)(Jr). Introductory psychosomatic dentistry. 1956. 3 CROGER (W S). Psychosomatic obstetrics, gynaecology, and endocrinology. 1962.			
5	BIOLINGUISTICS Study of the biological factors which cause or prevent the occurrence of various linguistic forms. 1 WOODGER (J H). Biology and language. 1964.	P&eG Linguistics application of Biology	P Lingui-stics	41:57
6	PSYCHOLINGUISTICS Study of the psychological factors which cause or prevent the occurrence of various linguistic forms. 1 OSGOOD (C E) and SEBEOK (T) Psycholinguistics. 1965. 2 AJURIAGUERR (J De), and others. Problemes de psycholinguistique. 1963.	P&eS Linguistics application of Psychology.	P Lingui-stics	41:159.9

a	b	c	d	e
7	SOCIOLINGUISTICS Study of the sociological factors which cause or prevent the occurrence of various linguistic forms. 1 BRIGHT (W S). Sociolinguistics. 1967.	P&eY Linguistics, application of Sociology.	P Linguistics	41:301
8	PSYCHOBIOLOGY Biological basis of human behaviour. 1 GREENFIELD (N S) and LEWIS (W C), Ed. Psychoanalysis in current biological thought. 1965.	S&eG Psychology application of Biology	S Psychology	159.9:57
9	EDUCATIONAL PSYCHOLOGY Use of the principles and methods of psychology in the field of Education. 1 GARRISON (K C) and others. Educational psychology. 1965.	T&eS Education application of Psychology	T Education	37.015

a	b	c	d	e
10	EDUCATIONAL SOCIOLOGY Application of the principles of sociology to a study of the educational objective and organisation.	T&eY Education application of Sociology	T Education	37.301
11	STATISTICAL GEOGRAPHY Application of statistical calculus to geography 1 BERRY (B J L) and MARBLE (D F), Ed. A reader in statistical geography 1967. 2 DUNCAN (O D) and others. Statistical geography: Problems in analysing areal data. 1961.	U&eBT Geography application of Statistical Calculus.	U Geography	91:311
12	POLITICAL SOCIOLOGY Use of the principles and methods of sociology in the study of political phenomena and processes. 1 BHASKARAN (R). Sociology of politics. 1967	W&eY Political science application of Sociology.	W Political Science	32:301

a	b	c	d	e

2 COSER (Lewis A). Political sociology. 1966.

13 POLITICAL ECONOMY

The modern concept dealing with the interrelationship of political science and economic process.

1 MACHLUP (F). Political economy of monopoly. 1952.
2 WILLES (P J). Political edonomy of communism. 1962.

X&gW

Economics influenced by Political Science.

X Economics 33:32

14 BIOSOCIOLOGY

Application of the principles of biology to the study of social interactions.

1 SUMMER (W G). Social Darwinism. 1963

Y&eG

Sociology influenced by Biology

Y Sociology 301:57

15 CYBERCULTURE

Influence of the development in engineering and technology on culture

1 HILTON (M A). Age of cyberculture, a series. 1963
2 --. Ethos for the age of cyberculture. (Data processing Yearbook. 1965).

Y;1&gCZ

Sociology Culture, influenced by Engineering and Technology.

Y Soicology 008:6

7 CORE COMPONENT

We shall now examine the basis for the guiding principles mentioned in Sec 61. For this purpose, it will be helpful to examine the nature of the subject occurring in Phase 1 of a Complex Subject presenting a Bias, Application, or Influencing relation.

71 Entity Forming the Focus of Study

In general, a subject -- that is, a systematised body of ideas -- going with a (BS) denotes a study of the property of some entity or other, concrete or conceptual. For example, a subject in the Natural sciences may study the origin, and physical, chemical, and biological property of an entity, the entity being in normal condition or is subjected to various kinds of action. Every subject going with that (BS) must deal with that entity, whether its name is explicitly mentioned or not in a particular document on that subject. For example, every subject deemed to go with the (BS) "G Biology", will be a study about a living organism whether or not the latter is explicitly mentioned in a particular document dealing with a subject in biology. Similarly, every subject going with the (BS) "I Botany" will be a study about plant; every subject going with the (BS) "T Education" will be a study about educand; every subject going with the (BS) "V History" will be a study about human community; and every subject going with the (BS) "Sosiology" will be a study about social group. For convenience, let us call this

entity forming the focus of study in all the subjects going with the respective (BS), as the "Core component".

72 Core Component as (1P1) Isolate

The following further observations are relevant here:

In the particular pattern of arranging the components of a subject prescribed by the General Theory of Library Classification on which CC is based:

1 The core component in subjects going with a (BS) is to be found in the schedule of (1P1) isolates for those subjects;

2 In determining the relative degree of affinity between subjects going with different (BS), greater weightage should be given to the commonness of the respective core components -- that is, (1P1) isolates -- than to that among the other components; and

3 In determining the difference between subjects going with different (BS), greater weightage should be given to the difference in the respective core components -- that is, (1P1) isolates -- than to that among the other components.

73 Conformity to Basic Principles of Sequence

The discussion in Sec 71 and 72 indicates that the sequence of the components of a subject according to CC, namely, Basic Subject, immediately followed by the core component -- that is, (1P1) isolates -- followed by other components, simultaneously conforms to the

1 Wall-Picture Principle; and therefore,

2 The Absolute Syntax of ideas; and
3 The Principle of Decreasing Concreteness.

74 Subject in Phase 1 of Complex Subject

In CC in the representation of a Complex Subject presenting either a Bias, or an Application, or an Influencing relation between two subjects, the subject of Phase 1 contains the core component of the study. For instance, in a "Bias" relation the subject in Phase 2 represents the group of specialists for whom the treatment of the subject in Phase 1 is oriented -- (Psychology for teachers); in an "Application" phase relation, the subject in Phase 2 is applied for the study and development of the subject in Phase 1 (Application of Statistics to Geography); and in an "Influencing" phase relation the subject in Phase 1 is the one being influenced or impacted upon by the subject in Phase 2 (Influence of Physics on Biology).

Therefore, the filiation of such a Complex Subject with other non-complex subjects should be determined by the subject in Phase 1. This approach is helpful in determining the filiation of a new Fused (MS) with the fusing (MS) in Phase 1 of the complex Subject. Examples are given in Sec 75. Incidentally, in this approach, the basis of the guiding principles mentioned in Sec 61 becomes evident.

75 Some New Fused (MS)

751 Biomechanics, Biophysics, Biochemistry

Consider the subjects: (1) Biomechanics; (2) Biophysics; and (3) Biochemistry.

"Biomechanics" is the study of the mechanics -- that is, the behaviour of a system under the action of given forces -- of living organisms.

"Biophysics" is essentially the use of the ideas of physics and chemistry to study the structure of living organisms and the mechanisms of life processes.

"Biochemistry" is the study of the substances, occurring in living organisms, the processes by which the substances enter into or are formed in the organisms and react with each other and the environment, and the methods by which the substances and processes are identified, characterised and measured.

Thus, every subject in each of the fields -- biomechanics, biophysics, and biochemistry -- is concerned with the study of one variety of property or other of living organisms. Variety of living organisms are enumerated in the schedule of (1P1) for Biology. Therefore, subjects in each of these fields have greater affinity to subjects in the field of Biology. Hence, it would be helpful to a majority of the specialists in each of the fields -- biomechanics, biophysics, and biochemistry -- in the subjects are placed adjunct to Biology, rather than if distributed under mechanics, physics and chemistry, each of which deals essentially with non-living systems.

752 Astrophysics, Astrochemistry, Astrobiology

Similarly, consider the subjects

1 Astrophysics;
2 Astrochemistry; and
3 Astrobiology.

Essentially, these subjects are respectively

concerned with the study of the physical, chemical and biological properties of celestial bodies. .The study of celestial bodies is the core of "Astronomy". In other words, every subject deemed to fall in the field of "Astronomy" would represent a study of some property -- such as, physical, chemical, or biological -- of celestial bodies, whether the latter is explicitly mentioned or not. Therefore, subjects in each of the fields -- astrophysics, astrochemistry, and astrobiology -- have greater affinity to subjects in the field of astronomy. Hence, it would be helpful to a majority of the specialists if these subjects are placed adjunct to astronomy, rather than if distributed under physics, chemistry, and biology.

753 Geophysics, Geochemistry

Similarly, consider the subjects (1) Geophysics and (2) Geochemistry.

Essentially, Geophysics is the use of ideas of physics in the study of the earth; and Geochemistry is the study of the chemical composition of the earth and the physical and chemical processes which have produced the observed distribution of the elements and nuclides. The study of the earth is the subject of "Geology". In other words, every subject deemed to fall in the field of geology would represent the study of some property -- such as, physical or chemical -- of the earth, whether the latter is explictly mentioned or not. Therefore, subjects in each of the fields -- geophysics and geochemistry -- have greater affinity to subjects in the field of geology. Hence, it would be helpful to a majority of the specialists

if these subjects are placed adjunct to geology, rather than if distributed under physics and chemistry.

754 Sequence in CC

The placing of the new Fused (MS) arrived at in the Sec 752, 753, and 754 is conformed to in the schedule of (MS) in CC, ed 7. Thus,

BX	Astronomy	H	Geology
BYC	Astrophysics	HV	Geophysics
BYE	Astrochemistry	HVT	Geochemistry
BYG	Astrobiology		
G	Biology		
GWB	Biomechanics		
GWC	Biophysics		
GWE	Biochemistry		

76 Representation of Fused (MS) in UDC

761 Main Subject and Basic Subject

For convenience of discussion, we shall take the UDC classes 0 to 9 as (MS) and the first array division of each of these (MS) as non-Main (BS) in UDC (3).

762 Remarks

1 Any new subject has to be deemed to go with one or other of the existing (MS). In other words, there is no provision for forming new (MS).

2 Some of the Fused (MS) are enumerated in UDC as Compound Subjects. For example,

523.03	Astrophysics	577.1	Biochemistry
523.04	Astrochemistry	577.3	Biomechanics and Biophysics
523.07	Astrobiology	66.0	Chemical engineering

21 From Table 1 in Sec 541, it may be noted that 15 out of the 30 Fused (MS) incorporated in CC, ed 7, are enumerated as Compound Subjects in UDC.

3 The (MS) to which each of such enumerated Compound Subjects has been deemed to go in UDC is more or less the same as the (MS) to which the corresponding Fused (MS) is deemed to be an adjunct in CC.

4 In Table 1, the UDC number for the remaining 15 Fused (MS) has been constructed according to the prescription of the general theory of classification. Therefore, the (MS) to which each of these Compound Subjects is deemed to go in UDC is more or less the same as the (MS) to which the corresponding Fused (MS) is deemed to be adjunct in CC.

5 In constructing the UDC (CN) for the Compound Subjects, it was necessary to use a subject as if it were an isolate. And the use of " : " (colon) as the connecting digit does not indicate the specific relation between the components. For example, a weak bond strength, such as Phase Relation is indicated in the same way as a more stronger bond such as the Facet Bond or even the Fusion Bond. As a result, the UDC (CN) is not expressive and coextensive with the subject. In the table in Sec 82, it has been shown that it is possible to have subjects with the same components, but with different strength of bond among the components. This can give rise to homonym in (CN) with UDC, as illustrated in the following table:

SN	Subject	Class Number	
		UDC	CC
1	Influence of Cybernetics on Economics	33:007	X&gBV
2	Economico-Cybernetics	33:007	XV

6 However, where the Fused (MS) is enumerated in the UDC schedules, at least as a Compound Subject, this homonym is resolved as illustrated in the following table:

SN	Subject	Class Number	
		UDC	CC
1	Influence of Statistical Calculus on Economics	33:31	X&gBT
2	Econometrics ..	330.115	XT

7 The provision in UDC to represent "Econometrics" at least as a Compound Subject implies that the scheme recognises the difference in strength of bond among the components in the two subjects. It would indeed be helpful if the different varieties of strength of bond -- such as, Phase Bond of different kinds, Facet Bond of different kinds, and Fusion Bond -- as recognised in the General Theory of Library Classification, are represented in the formation of (CN) by UDC. It will facilitate a more coextensive and expressive classification by UDC.

8 CONCLUSION

81 Analogy to a Natural Process

The concepts of Fusion and Fused (MS) are helpful in the design and development of schemes for classification fit to meet the developments in the universe of subjects on the one hand and the psychology of readers on the other. This is analogous to a phenomenon in nature. In nature, a living dynamic system, as it grows beyond certain convenient limits, either divides into smaller parts or the existing parts fuse together to form semi-independent units This helps the system, taken as a whole, to meet the pressures from and maintain, a dynamic equillibrium with its environment -- internal as well as external.

82 Resolution of a Homonym

Heretofore, a subject dealing with the mutual relation between subjects going with two different (BS), has been represented in the same way as the discipline emerging out of the mutual interaction between these subjects. Both these have been represented as a Phase Relation between the two fusing subjects. The concept of Fused (MS), with which the new discipline emerging from the mutual interaction between the fusing subjects, may be deemed to go, has in a sense, resolved this homonym. The subjects of the following documents are illustrative of this. Col (b) mentions a subject to be represented as Phase Relation between two subjects; Col (c) mentions a subject to be represented as a Fused (MS), the fusing subjects being the two subjects occurring in the two phases of the Complex Subject mentioned in Col (b).

SN	Phase Relation	Fused (MS)
a	b	c
1	BT&bX Statistical Calculus biased to Economics NELSON (B L). Elements of modern statistics for students of economics and business. 1965.	XT Econometrics CHRIST (C F). Econometric methods and models. 1966.
2	C&bG Physics biased to Biology. RICHARDSON (J A). Essential physics for biology students. 1961.	GWC Biophysics CASEY (E J). Biophysics: Concepts and mechanisms. 1961.
3	E&bG Chemistry biased to Biology SACKHEIM (G O). Introduction to chemistry for biology students. 1964.	GX Biochemistry WEST (E S) and TODD (W R). Textbook of biochemistry. 1957

83 Problems for Investigation

1 It would be helpful to formulate principles for arranging in a helpful sequence the different Adjunct (MS) to a traditional (MS).

2 It would be helpful to formulate guiding principles to recognise the stage at which a Fused (MS) emerges as a result of the interaction between subjects going with two or more (MS).

9 BIBLIOGRAPHICAL REFERENCES

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2 Sec 1 --. Ed 3. 1967. Chap CR.

3 Sec 761 UNIVERSAL DECIMAL Classification. Abridged English edition. BS1000A: 1961. Ed 1. Note on the Dewey Decimal Classification and the UDC. P 4.

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COMPATIBILITY OF UDC WITH A FREELY FACETED VERSION OF CC: A CASE STUDY.

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[A Basis of Reference for the study of compatibility between schemes for library classification is formulated. Twenty micro subjects embodied in technical reports in the field of "Aero-dynamics of Aircraft Wing" have been selected for comparing the compatibility of UDC and CC with the Basis of Reference and among themselves. Each of the subjects has been facet analysed using the postulates, canons and principles of the general theory of library classification. Each subject was then classified by a depth version of CC and the result compared with the UDC number given on the catalogue cards supplied with each technical report. The differences, if any, in the two schemes in representing the components of subjects and the interrelation among them precisely are commented upon. An UDC number of greater coextensiveness to the facet analysis has been constructed wherever found necessary. The sequence of the subjects according to this UDC number closely parallels the sequence of subjects according to the CC number. The helpfulness of basing the design of UDC and of classifying on the general theory of library classification is emphasised].

1 COMPATIBILITY BETWEEN SCHEMES FOR CLASSIFICATION

11 Basis for Study of Compatibility

For studying the compatibility between two

schemes for classification, it is helpful to have a Basis of Reference (5). If the schemes for classification are found to be compatible with this Basis of Reference, then the schemes may be said to be compatible with each other.

12 Basis of Reference

The Basis of Reference may be a scheme for classification which

1 Gives a unique and coextensive representation of the subject of each document -- that is, it is capable of representing each of the component ideas in each subject and the precise degree of inter-relation between the components;

2 Arranges the subjects in the universe of subjects in a sequence helpful to the majority of readers -- that is, according to the mutual filiation among the subjects so as to secure an APUPA (Alien-, Penumbral-, Umbral-; Umbral-, Penumbral-, Alien), pattern among them;

3 Secures the same pattern of arrangement of the component ideas of

31 One and the same subject whenever it recurs,

32 Different subjects going with one and the same Basic Subject, and

33 Subjects going with different Basic Subjects;

4 Secures the helpful features mentioned in categories 1 to 3 above not only in respect of the classification of subjects of the past and of the

present but also in respect of the new subjects that may emerge from time to time in future; and for this purpose;

5 Is based on a sound general theory of library classification constituted out of the necessary hierarchy of guiding principles.

2 FACET SYNTAX

One of the basic postulates of the General Theory of Library Classification developed in India is that there is a particular fundamental pattern of sequence among the components of any Compound Subject that is helpful to the majority of readers. This pattern of sequence is denoted by the term 'Facet Syntax'. It is conjectured that the Facet Syntax would agree with the Absolute Syntax among the constituent ideas making up a compound subject. By Absolute Syntax is meant the syntax of ideas among the majority of normal intellectuals and is uninfluenced by linguistic syntax, which may vary from one language to another. It has been shown that the essential features of an efficient scheme for classification mentioned in categories 1 to 5 in Sec 12, can be secured by making the Facet Syntax parallel to the Absolute Syntax (1, 3).

3 DYNAMIC THEORY

Basing the design of a scheme for classification and the steps in classifying subjects on a sound theory of library classification would provide the necessary guiding principles for securing efficiency

in classifying the known subjects. However, the universe of subjects is turbulently dynamic and is throwing forth new subjects and new varieties of them from time to time. It is impracticable to envisage in advance all the kinds of developments in the universe of subjects in future. Only a few trends can be sensed at any one time. Therefore, there needs to be a built-in mechanism to guide the development of the scheme for classification in a consistent way along desirable lines to meet the needs of the future. This requires, in turn, continued research on the attributes of the universe of subjects and on the psychology of readers. The theory of library classification on which the design of the scheme is based, should be kept updated on the basis of the findings of such redearch. The necessary resilience and the self-perpetuation of the scheme of classification can be secured in this way.

4 SCOPE OF THE PAPER

The freely faceted version of the Colon Classification (=CC) based on an explicitly stated general theory of library classification, consisting of a hierarchy of about one hundred guiding principles, is the nearest approximation to the requirements mentioned in Sec 12, 2 and 3. The structuring of and Class Numbers for twenty selected subjects in "aerodynamics of aircraft wing", classified according to a depth version of CC (2) and also according to UDC are compared. It is shown that

by basing the steps in classifying on the postulates and principles of the General Theory of Library Classification, UDC can be made to provide a more coextensive representation of the subjects and also a consistent sequence of facets. Although this would not completely make up for the deficiencies of UDC due to its faulty design, it would make UDC more compatible with CC and also with the Basis of Reference.

5 EXAMPLES OF SUBJECTS

51 Subject

The subject of all the documents selected go with the Host Subject "B73,8 Aerodynamics". The documents are all technical reports received in the National Aeronautical Laboratory, Bangalore.

52 Classification

In a multifocal document -- that is, a document dealing with two or more subjects, each subject is given a separate Class Number. Each subject is classified

1 By CC, the schedule for "Air-vehicle Wing Production" (2) being used in association with the Host-Subject "B73,8 Aerodynamics";

2 By UDC, using the Class Number given on the catalogue cards supplied with each technical report. In the case of a multi-focal document, the catalogue cards supplied with the technical report gives the UDC number for one of the subjects only. Therefore, the UDC number for the other subjects

were constructed using the following schedules.

1 The UDC abridged ed (1961);

2 The expanded UDC schedule for 532.5 Fluid motion and 533.6 Gas dynamics, developed by the Classification Sub-Committee of the Aslib Aeronautical Group; and

3 The "Aero space engineering classification. A bibliographic classification on UDC principles ..." developed by the Aeronautical Group of Aslib. When a component idea does not have a number in UDC, the name of the idea in words has been used (6).

53 Examples of Subjects

In each example in the list of examples given below the following items of information are given:

1 Code Number and title of the technical report (a);

2 Facet analysis of the subject of the technical report according to the postulates, canons, and principles of the general theory of library classification (b);

3 Class Number according to UDC as given in the catalogue card supplied with the technical report and a verbal translation of the number (c);

4 Class Number according to CC (d); and

5 Remarks and UDC number wherever necessary, giving a more coextensive representation of the facet analysis of the subject given in (b) (c).

The verbal representation of the components of the UDC numbers in (c) and the CC number in (d) are given only for the first two or three examples for the purpose of illustration. For each of the other examples, a feature heading type of representation is given.

Example 1

a) ARC CP 694 Boundary layer characteristics of caret wings.

b) Dynamics (BS), Air-Aircraft-Delta shape (1P1); Boundary layer (1MP).

c) 533.693.3:532.526 Aerodynamics, Aircraft Wing, Delta shape, Boundary layer.

533.6 Aerodynamics.

533.69 Aerodynamic studies of aircraft elements including aerofoil.

533.693 Complete wings. Plan forms.

533.693.3 Delta wings. Double delta. Diamond. Arrowhead.

532.5 Fluid motion. Hydro-dynamics.

532.526 Boundary layer. Skin friction.

d) B73,8-19(D8,96B-Zon3);0j Aerodynamics, Aircraft wing-Delta shape; Boundary layer.

B7 Mechanics

B73 Dynamics

B73,8 Aerodynamics

B73,8-19 Aerodynamics-Special systems

D8,96B Aircraft wing

D8,96B-Zon3 Aircraft wing-Delta shape.

;0j Boundary layer.

e) 1 The UDC and the CC number is each coextensive with the facet analysis of the subject in (b);

2 The sequence of the components as represented in CC and UDC is the same as that in the facet analysis in (b);

3 Therefore, here UDC and CC are compatible with the Basis of Reference, and therefore compatible with each other;

4 However, UDC has to use compound subject -- for example "532.526 Fluid motion, Boundary layer" -- as if it were an isolate;

5 The different facets and speciators are not clearly differentiated, say by indicator digits, as in CC; and

6 Some of the components represent more than one idea in UDC as shown in (c).

Example 2

a) RAE TR 70146 Calculation of the downwash on the center line of a swept wing with given load distribution.

b) Dynamics (BS), Air-Aircraft wing-Delta shape - Swept - With centre load distribution (1P1); Downwash (1MP): Calculation (1E).

c) 533.6.048.3:533.6.048.1:533.693.1 Aerodynamics, Downwash, Aerodynamic loading, Aircraft element, Swept wings.

533.6.048 Aerodynamics. Airflow variable.

533.6.048.3 Wake. Slip-stream, Downwash.

533.693.1 Swept wings generally.

d) B73,8-19(D8,96B-Z0n3-Z0m-Zb13f);0H:b1 Aerodynamics, Aircraft wing-Delta shape-Swept-With center load distribution; Downwash: Calculation.

B73,8-19 Aerodynamics, Special systems.

D8,96B-Zon3-ZOm-Zb13f Aircraft wing, Delta shape- Swept-With centre distribution

;OH Downwash.

:b1 Calculation.

e) 1 The UDC number in (d) does not represent the speciator "Delta shape", and the isolate "Calculation".

2 The CC number is coextensive with the facet analysis in (c).

3 The sequence of the component ideas in the UDC number is different from that in the facet analysis in (b) which is conformed to by CC.

4 Therefore, here CC is compatible with the Basis of Reference whereas UDC is not. Therefore, UDC and CC are incompatible with each other.

5 Remarks similar to (3), (4), (5) in example 1 are applicable here also.

6 An UDC number of closer approximation to the facet analysis will be:

533.693.3:533.693.3.1:533.6.048.1:533.6.048.3:001.2

Example 3

a) ARC CP 562 Calculation of the lift slope and aerodynamic center of cropped delta wings at supersonic speeds.

b) Dynamics (BS), Air-Aircraft wing-Delta shape-Cropped tip-Subsonic leading edge (1P1); Lift (1MP): Calculation (1E); Wind tunnel-Supersonic velocity (2MM). /See also 4/.

c) 533.693.3. Aerodynamics, Aircraft wing, Delta shape.

d) B73,8-19(D8,96B-ZOn3-Zyk1-9rB);OzF:b1;1-9E Aerodynamics, Aircraft wing-Delta shape-Cropped tip-Subsonic leading edge; Lift: Calculation; Wind tunnel-Supersonic velocity

e) 1 The UDC number in (c) does not represent the speciators "cropped tip" and "subsonic leading edge" in (1P1) and the isolates "Lift", "Calculation" and "Wind tunnel-Supersonic velocity".

2 The CC number is coextensive with thefacet analysis in (b).

3 An UDC number of closer approximation to the facet analysis will be:

533.693.3:533.693.9/Cropped tip/:533.694.25 /533.6.011.32/: 533.6.013.13:001.2:533.6.07:533.6. .011.5

Example 4

a) ARC CP 562 Calculation of the lift slope and aerodynamic centre of cropped delta wings at supersonic speeds.

b) Dynamics (BS), Air-Aircraft wing-Delta shape-Cropped tip-Subsonic leading edge (1P1); Aerodynamic center (1MP): Calculation (1E); Wind tunnel-Supersonic speed (2MM) /See also 3/.

c) Not given

d) B73,8-19(D8,96B-ZOn3-Zyk1-9rB);045:b1;1-9E Aerodynamics - Aircraft win.. Delta shape-Cropped tip-Subsonic leading edge; Aerodynamic centre: Calculation; Wing tunnel-Supersonic velocity.

e) 533.693.3:533.693.9/Cropped tip/:533.694. 25/533.6.011.32/:533.6.013.152:001.2:533.6.07: 533.6.011.5

Here 533.6.013.152 represents "Pitching" only andnot "aerodynamic centre".

Example 5

a) ARC CP 624 Measurements of transient pressures on a narrow delta wing due to an upward gust.

b) Dynamics (BS), Air-Aircraft wing-Narrow delta shape (1P1); Pressure-Upward gust (1MP): Testing (1E); Ballistic technique (2MM).

c) 533.693.3:533.6.048.5:533.6.048.2:533.6.078 Aerodynamics, Aircraft wing, Delta shape, Gust loads, Pressure distribution, Ballistic and other special testing appratus and techniques.

533.693.3 Aerodynamics, Delta wings.

533.6.048 Airflow variable.

533.6.048.5 Gust loads. Accelerating stresses. Vg tests.

533.6.048.2 Pressure distribution.

533.6.078 Ballistic and other special testing apparatus and techniques .

d) B73,8-19(D8,96B-Z0n31);0f-0 Zd:fR;8 Aerodynamics, Aircraft wing-Narrow delta shape; Pressure distribution-Upward gust: Testing, Ballistic technique.

e) 1 The UDC and CC numbers are each more or less coextensive with the facet analysis in (b).

2 However, the UDC number represents "Delta" but not "Narrow delta"; and the sequence between "Pressure load" and "Gust load" are reversed.

3 But the correct sequence as required in the facet analysis can be easily secured by reversing the sequence of these components.

4 Remarks similar to (3), (4), and (5) in example 1 are applicable here.

Example 6

a) ARC CP 541 Ground effect on a 55° swept M-wing of aspect ratio 5.

b) Dynamics (BS), Air-Aircraft wing-M shape-Backward sweep 55°-Aspect ratio 5(1P1); Lift (1MP) influenced by Ground effect (1MP): Testing (1E); Wind tunnel-Low speed (2MM).

c) 533.628:533.693.4 Aerodynamics, Ground interference, Wings with sweep varying along the span.

533.682 Aerodynamic studies of bodies moving on or near the ground, Aircraft ground interference, Hovercraft.

533.693.4 Sweep varying along the span. Crescent, Cranked etc.

d) B73,8-19(D8,96B-Z0nM-Z0mH55-ZtD5);0zF&r0y: fR;1-9B Aerodynamics, Aircraft wing-M shape-Backward sweep 55-Aspect ratio 5; Lift influenced by Ground effect: Testing; Wind tunnel-Subsonic velocity.

e) 1 The UDC number in (d) is not coextensive with the facet analysis in (b). Not all the components are represented and there is a variation in the sequence of even the components represented.

2 The CC number is more coextensive with the facet analysis.

3 An UDC number of closer approximation to the facet analysis will be:

533.693.9⌈M⌉:533.693.4⌈55°⌉:533.6.041⌈5⌉: 533.6.013.13:533.682:001.4:533.6.071:533.6.011.34

4 Remarks similar to (3), (4) and (5) in example 1 are applicable here.

Example 7

a) ARC CP 525 Pressure distribution at zero lift for delta wing with rhombic cross section.

b) Dynamics (BS), Air-Aircraft wing-Rhombic-Delta shape (1P1); Pressure at zero lift (1MP): Testing (1E); Wind tunnel-Supersonic velocity (2MM).

c) 533.693.3:533.6 Aerodynamics, Aircraft wing, Delta shape, Pressure distribution.

d) B73,8-19(D8,96B-Z0s24-Z0n3);0f-0zk: fR;1-9E Aerodynamics, Aircraft wing-Rhombic delta shape; Pressure at zero lift: Testing; Wind tunnel-Supersonic velocity.

e) 1 The UDC number in (c) is not coextensive with the facet analysis in (b).

2 The CC number is more coextensive with the facet analysis.

3 An UDC number more closely approximating the facet analysis, will be:

533.693.6/Rhombic/:533.693.3:533.6.048.2:
533.6.013.13:001.4:533.6.071:533.6.011.5

4 Remarks similar to (3), (4) and (5) in example 1 are applicable here.

Example 8

a) ARC CP 606 Calculated effect of the station of maximum cross sectional area on the wave drag of delta wings.

b) Dynamics (BS), Air-Aircraft wing-Diamond cross section-Delta shape-Subsonic leading edge (1P1);Drag (1MP): Measurement.

c) 533.693.3:533.692.2:533.6.013.12:533.6.048.2 Aerodynamics, Aircraft wing, Delta shape, Diamond cross section, Drag, Pressure distribution.

d) B73,8-19(D8,96B-Z0s3-Z0n3-9rB);0c:b6 Aerodynamics (BS), Aircraft wing-Diamond cross section-Delta shape-Subsonic leading edge; Drag: Measurement.

e) 1 The UDC number is nearly coextensive with the facet analysis in (b). The subject is a multifocal one.

2 The CC number is more coextensive with the facet analysis.

3 An UDC number of closer approximation to the facet analysis will be:

533.693.9/Diamond cross section/:
533.693.3:533.694.24/533.6.011.32/:
533.6,013.12:001.2

4 Remarks similar to (3), (4) and (5) given in example 1 are applicable to the above UDC number.

CE53 Ranganathan (T) and Neelameghan

Example 9

a) ARC CP 576 Low speed wind tunnel tests on sharp edged gothic wings of aspect ratio 3/4.

b) Dynamics (BS), Air-Aircraft wing-Gothic shape-Cambered-Aspect ratio 0.75 (1P1); Lateral stability (1MP): Testing (1E); Wind tunnel Low velocity-Oil flow technique [See also 10].

c) 533.693.3:533.6.013-413 Aerodynamics, Aircraft wing, Delta shape, Lateral stability.

d) B73,8-19(D8,96B-ZOz6-ZOzr-ZtDO=75); O9h:fR;1-9B-f5 Aerodynamics, Aircraft wing-Cambered-Aspect ratio 0.75; Lateral stability: Testing; Wind tunnel-Subsonic velocity-Oil flow technique.

d) 1 The UDC number in (c) does not represent the speciators "gothic shape" and "Cambered" in (1P1), and the isolates "Testing" and "Wind tunnel-Low speed Oil-flow technique".

2 The CC number is fully coextensive with the facet analysis.

3 An UDC number of closer approximation to the facet analysis in (b) will be:

533.693.9[Gothic]:533.6.043.1:533.6.041 [0.75]:533.6.013.413:001.4:533.6.07: 533.6.011.3:[Oil flow technique].

4 Remarks similar to (3), (4) and (5) in example 1 are applicable to the above UDC number.

Example 10

a) ARC CP 576 Low speed wind tunnel tests on sharp edged gothic wings of aspect ratio 3/4.

b) Dynamics (BS), Air-Aircraft wing-Gothic shape-Uncambered-Aspect ratio 0.75 (1P1); Lateral stability (1MP): Testing (1E): Wind tunnel-Low velocity-Oil flow technique. [See also 9].

c) Not given.

d) B73,8-19(D8,96B-Z0z6-Z0zs-ZtD0=75);09h: fR;1-9B-f5 Aerodynamics, Air-craft wing-Gothic-shape-Uncambered-Aspect ratio 0.75; Lateral stability : Testing; Wind tunnel-Subsonic velocity-Oil flow technique.

e) 533.693.9 /Gothic/:533.6.043.12:533.6.041./0.75/:533.6.013.413:001.4:533.6.07:533.6.011.3: /Oil flow technique/.

Example 11

a) RAE TR 65107 Some notes on the calculation of the zero lift wave drag of slender wings with swept trailing edges.

b) Dynamics (BS), Air-Aircraft wing-Thin cross section-Backward sweep-Subsonic leading edge-Supersonic trailing edge (1P1); Drag-Zero lift (1MP): Calculation.

c) 533.6.013.128:533.693.3 Dynamics of aeronautical machines, Wave resistance, Delta wings.

d) B73,8-19(D8,96B-Z07D-Z0mH-9rB-0E);0c-0zR:b1 Aerodynamics, Aircraft wing, Thin cross section, Backward sweep, Subsonic leading edge, Supersonic trailing edge; Drag-Zerolift: Calculation.

e) 1 The UDC number in (c) does not represent several of the speciators in (1P1) and the sequence between "Wave resistance" and "Delta wings" has been reversed in relation to the facet analysis in (b).

2 The CC number is more coextensive.

3 An UDC number of a closer approximation to the facet analysis in (b) will be:

533.693.9/Thin cross section/:533.693.4:
533.694.25 /533.6.011.32/:533.694.24
/Trailing edge flap/ /533.6.011.5/:
533.6.013.12:001.2

Example 12

a) ARC CP 530 Exploratory tests on a thin delta wing in the flow field of a rectangular fore plane at Mach number 1.8.

b) Dynamics (BS), Air-Aircraftwing-Thin cross section-Delta shape-Sharp edge (1P1); Pitching moment (1MP): Testing (1E); Wind tunnel-Mach number 1.8 (2MM).

c) 533.693.3:533.695.12:533.6.011.5 Aerodynamics, Aircraft wing, Delta shape, Flow at supersonic velocity.

d) B73,8-19(D8,96B-Z07D-Z0n3-zkc);04:fR;1-9E1=8 Aerodynamics, Air-craft wing-Thin cross section-Delta shape-Sharp edge; Pitching: Testing; Wind tunnel-Mach number 1.8.

e) 1 The UDC number in (d) is not coextensive with the facet analysis in (b).

2 The CC number is more coextensive .

3 An UDC number of a closer approximation to the facet analysis will be:

533.693.9 ⌈Thin cross section⌋: 533.693.9 ⌈Sharp edge⌋: 533.6.013.512:001.4:533.6.071:533.6.011.5

4 Remarks similar to (3), (4) and (5) in example 1 an applicable to the above UDC number.

Example 13

a) ARC CP 670 Free flight measurements of the zero lift drag of a slender ogee wing at transonic and supersonic speeds.

b) Dynamics (BS), Air-Aircraft wing-Thin cross section-Ogee shape (1P1); Zero lift drag (1MP): Measurement (1E): Free flight-Transonic velocity (2MM). ⌈See also 14⌋

c) 533.693.3:533.6.013.12:533.6.011.3/5 Aerodynamics, Aircraft wing, Delta shape, Drag, Flow at transonic/supersonic velocity.

d) B73,8-19(D8,96B-Z07D-Z0z5):fR;Zm-9D Aerodynamics, Aircraft wing-Thin cross section-Ogee shape; Drag-Zero lift: Testing; Free flight-Transonic velocity.

e) 1 The UDC number in (d) is not coextensive with the facet analysis in (b). It is a multi-focal subject.

2 The CC number is more coextensive.

3 An UDC number of closer approximation to the facet analysis will be:

533.693.9/Thin cross section/:533.693.9/Ogee/:533.6.013.12:001.2:533.6.055:533.6.011.35

4 Remarks similar to (3), (4) and (5) given for example 1 are applicable to the above UDC number.

Example 14

a) ARC CP 670 : Free flight measurements of the zero lift drag of a slender ogee wing at transonic and supersonic speeds.

b) Dynamics (BS), Air-Aircraft wing-Thin cros section-Ogee shape (1P1);Zero lift drag (1MP)-Measurement (1E); Free flight-Supersonic velocity (2MM) /See also 13/.

c) Same as in 13.

d) B73,8-19(D8,96B-Z07D-Z0z5);fR;Zm-9E Aerodynamics, Aircraft wing-Thing cross section-Ogee shape; Drag-Zero lift: Testing; Free flight-Supersonic velocity.

e) 1 See remarks for example 13.

2 An UDC number of closer approximation to the facet analysis in (c) will be:

421

533.693.9 / Thin cross section / : 533.693.9 / Ogee / : 533.6.013.12:001.2:533.6.055:533.6.011.5

Example 15

a) ARC CP 585 Experimental investigation of the characteristics of an ogee wing from M 0.4 to M 1.8.

b) Dynamics (BS), Air-Aircraft wing-Thin cross section-Ogee shape-Aspect ratio 1.2 (1P1); Longitudinal static stability (1MP): Testing (1E); Wind tunnel-Mach number 0.4 to 1.8.

c) 533.693.3:533.6.011:34/5:533.6.013.412 Aerodynamics, Aircraft wing, Delta shape, subsonic to supersonic flow, Longitudinal stability.

d) B73,8-19(D8,96B-Z07D-Z0z5-ZtD1=2);09k: fR;1-9E1=4 ←9B0=4 Aerodynamics, Aircraft wing-Thin cross section-Ogee shape-Aspect ratio 1.2; Longitudinal static stability: Testing; Wind tunnel-Mach number 0.4 to 1.8.

e) 1 The UDC number in (c) is not coextensive with the facet analysis in (b).

2 The CC number is more coextensive.

3 An UDC number of closer approximation to the facet analysis will be:

533.693.9 / Thin cross section / : 533.693.9 / Ogee / :533.6.041 / 1.2 / :533.6.013.412:001.4:533.6.071:533.6.011.34/5

4 Remarks similar to (3), (4), and (5) for example 1 are applicable to the above UDC number.

Example 16

a) ARC CP 1130 Experimental investigation of the effect of trailing edge sweep back on the subsonic longitudinal characteristics of slender wings.

b) Dynamics (BS), Air-Aircraft wing-Thin cross section-Ogee shape (1P1); Drag (1MP) influenced by Trailing edge-Sweep back. /See also 17, 19, and 19/.

c) 533.693.3:533.6.013.412:533.69.01:533.6.013.2:533.6.013.13:533.6.013.152:533.6.011.32 Aerodynamics, Aircraft wing, Delta shape-Longitudinal stability, Forces and moments, Unsteady motion, Lift, Pitching, Subsonic flow.

d) B73,8-19(D8,96B-Z(XB)-Z07D-Z0z5)0c&gD8, 96B-zZa0mH Aerodynamics, Aircraft wing-for Subsonic aircraft-Thin cross section-Ogee shape; Drag influenced by Trailing edge-Sweep back.

e) 1 The UDC number in (d) does not represent all the attributes of the wing, as indicated in the facet analysis.

2 The document is a multifocal one dealing with several coordinate isolates in (1MP). In the UDC number all these isolates are merely stringed together using colon. Each subject should preferably be given a separate number as in a cross reference or subject analytical entry.

3 The CC number in (c) represents only one isolate idea in (1MP). Class numbers for each of the other isolates in (1MP) represented in the subject of the document can be constructed.

4 An UDC number more closely approximating the facet analysis in (b) will be:

533.692/532.6.011.32/:533.693.9/Thin cross section/:533.693.9/Ogee/:533.6.013.124:533.694.24/Trailing edge flap/ /Sweep back/.

Example 17

ARC CP 1130 Experimental investigation of the effect of trailing edge sweep back on the subsonic longitudinal characteristics of slender wings.

423

b) Dynamics (BS), Air-Aircraft wing-Thin cross section-Ogee shape (1P1); Lift (1MP) influenced by Trailing edge sweep back. / See also 16, 18, and 19 /.

c) 533.693.3:533.6.013.412:533.69.01:533.6.013.2:533.6.013.13:533.6.013.152:533.6.011.32 Aerodynamics, Aircraft wing, Delta shape, Longitudinal stability, Forces and moments, Unsteady motion, Lift, Pitching, Subsonic flow.

d) B73,8-19(D8,96B-Z(XB)-Z07D-Z0z5);0zF&sg D8,96B-zZaOmH Aerodynamics, Aircraft wing-for Subsonic aircraft-Thin cross section-Ogee shape; Lift influenced by Trailing edge-Sweep back.

e) See remarks in example 16.

Example 18

a) ARC CP 1130 Experimental investigation of the effect of trailing edge sweep back on the subsonic longitudinal characteristics of slender wings.

b) Dynamics (BS), Air-Aircraft wing-Thin cross section-Ogee shape (1P1); Pitching (1MP) influenced by Trailing edge-Sweep back (1P1) / See also 16, 17, and 19 /.

c) 533.693.3:533.6.013.412:533.69.01:533.6.013.2:533.6.013.13:533.6.013.152:533.6.011.32 Aerodynamics, Aircraft wing-for Subsonic aircraft-Thin cross section-Ogee shape; Pitching influenced by Trailing edge-Sweep back.

d) See remarks in example 16.

Example 19

a) ARC CP 1130 Experimental investigation of the effect of trailing edge sweep back on the subsonic longitudinal characteristics of slender wings.

b) Dynamics (BS), Air-Aircraft wing-Thin cross section-Ogee shape (1P1); Longitudinal stability (1MP) influenced by Trailing edge-Sweep back. /See also 16, 17, and 18/.

c) 533.693.3:533.6.013.412:533.69.01:533.6.013.2:533.6.013.13:533.6.013.152:533.6.011.32 Aerodynamics, Aircraft wing, Delta shape, langitudinal stability, Forces and moments, Unsteady motion, Lift, Pitching, Subsonic flow.

d) B73,8-19(D8,96B-Z(XB)-Z07D-Z0z5);09k&gD8, 96B-zZaOmH Aerodynamics, Aircraft wing-for Subsonic aircraft-Thin cross section-Ogee shape; Longitudinal static stability influenced by Trailing edge-Sweep back.

e) See remarks in example 16.

Example 20

a) ARC CP 757 Collection of data on the lift dependent drag of uncambered slender wings at supersonic speeds.

b) Dynamics (BS), Air-Aircraft wing-for Supersonic aircraft-Thin cross section-Uncambered (1P1); Drag (1MP).

c) 533.693.3:533.013.124 Aerodynamics, Aircraft wing, Delta shape, Drag.

d) B73,8-19(96B-Z(XE)-Z07D-Z0z5);0c Aerodynamics, Aircraft wing - for Supersonic aircraft - Thin cross section-Uncambered; Drag.

e) 1 The UDC number in (c) is not coextensive with the facet analysis in (b). The CC number is more coextensive.

2 An UDC number of closer approximation to the facet analysis will be:

533.693/532.6.011.5/:533.693.9/Thin cross section/: 533.6.043.12:533.6.013.124

3 Remarks similar to (3), (4) and (5) in example 1 are applicable to this UDC number.

425

Example 21

a) RAE TN Aero 2864 Design of very thick aerofoils for moderately high subsonic speeds.

b) Dynamics (BS), Air-Aircraft wing-for Freight carrier aircraft-Subsonic velocity-Thick cross section-Backward sweep-Passenger carrier in wing (1P1); Pressure (1MP); Distribution (1MP2) influenced by Thickness/chord ratio (1MP).

c) 533.652.5:533.692:533.693.4:533.6.048.2:533.6.011.32 Aerodynamics, All wing aircraft, Wing section, Sweep ranging along span, Pressure distribution, Subsonic flow.

d) B73,8-19(D8,96B-Z(Zc-XB)-Z07F-ZOmH-Zq3); Of;b33&rOZG Aerodynamics, Aircraft wing - for Freight carrier - Subsonic velocity-Thick cross section-Backward sweep-Passenger carrier in wing; Pressure; Distribution influenced by Thickness-chord ratio.

e) 1 The UDC number does not represent all the attributes of the type of aircraft for which the wing is to be fitted; also the influencing factor "Thickness/Chord ratio" is not represented.

2 The CC number is more or less coextensive with the facet analysis in (c).

3 An UDC number of closer approximation to the facet analysis will be:

533.693.9/629.137:656.7:533.6.011.327:533.693.3/Thick cross section/:533.693.4:533.6.048.2:533.6.043

4 Remarks similar to (3), (4) and (5) in example 1 are applicable to this UDC number

6 SEQUENCE OF SUBJECTS

61 Arrangement by CC Number

The examples in the preceding section have been arranged according to the ordinal value of the digits in the CC number for each of the subjects. The remarks in category (e) for each of the examples indicates that in most of the cases the CC number is coextensive with the facet analysis of

the corresponding subject, as indicated in category (d)in each example. The facet analysis of each subject, as has already been mentioned, is based on the postulates and principles of the General Theory of Library Classification. Hence, the arrangement of the subjects according to the CC number would be helpful to a majority of the specialists in the subject.

62 Arrangement by UDC Number

In the following table the subjects are arranged according to the ordinal value of the UDC number given in

1 Category d (that is, as given in the catalogue card supplied with the technical report) in the examples in Sec (col a); and

2 Category (e) (that is, constructed to closely approximate the facet analysis) in the examples in Sec 53 (col c).

Col(b) and(d) give the corresponding serial number of the subjects arranged according to CC number (See Sec 53).

621 Sequence of Subjects by UDC

UDC number as given in the catalogue card supplied with the technical report	SN of subject arranged by CC number	UDC number constructed to approximate the facet analysis of subject	SN of subjects arranged by CC number
a	b	c	d
533.6.013.128:533.693.3	11	533.693.3:532.526	1

UDC number as given in the catalogue card supplied with the technical report	SN of subject arranged by CC number	UDC number constructed to approximate the facet analysis of subject	SN of subjects arranged by CC number
a	b	c	d
533.6.048.3:533.6.048.1:533.693.1	2	533.693.3:533.693.3.1:533.6.048.1:533.6.048.3:001.2	2
533.652.5:533.692:533.693.4:533.6.048.2:533.6.011.32	21	533.693:3.533.693/cropped tip/:533.694.25/533.6.011.32/:533.6.013.13:001.2:533.6.07:533.6.011.5	3
533.682:533.693.4	6	533.693.3:533.693.9/cropped tip/:533.694.25/533.6.011.32/:533.6.013.152:001.2:533.6.07:533.6.011.5	4
533.693.3	3	533.693.3/M/:533.693.4/550/:533.6.041/5/:533.6.013.13:533.682:001.4:533.6.071:533.6.011.34	6
533.693.3:532.526	1	533.693.3/Narrow/:533.6.048.2:533.6.048.5:533.6.078	5

a	b	c	d
533.693.3:533.013.124	20	533.693.6/Rhombic/: 533.693.3:533.6.048.2:533.6.013.13:001.4:533.6.071:533.6.011.5	7
533.693.3:533.6	7	533.693.7/Diamond shape/:533.693.3:533.694.24/533.6.011.32/:533.6.013.12:001.2	8
533.693.3:533.6.011.34/5:533.6.013.412	15	533.693.9/Gothic/:533.6.043.1:533.6.041/0.75/:533.6.013.413:001.4:533.6.07:533.6.011.3/Oil flow technique/	9
533.693.3:533.6.013.12:533.6.011.35	13	533.693.9/Gothic/:533.6.043.12:533.6.041/0.75/:533.6.013.413:001.4:533.6.07:533.6.011.3:/Oil flow technique/	10
533.693.3:533.6.013.412:533.69.01:533.6.013.2:533.6.013.13:533.6.013.152:533.6.011.32	16 to 19	533.693.9/Thin cross section/:533.693.4:533.694.25/533.6.011.32/:533.694.24/533.6.011.5/:533.6.013.12:001.2	11
533.693.3:533.6.013.413	9	533.693.9/Thin cross section/:533.693.9/Sharp edge/:533.6.013.512:001.4:533.6.071:533.6.001.5	12
533.693.3:533.6.048.5:533.6.048.2:533.6.078	5	533.693.9/Thin cross section/:533.693.9/Ogee/:533.6.013.12:001.2:533.6.055:533.6.011.35	13

a	b	c	d
533.693.3:533.692.2:533.6.013.12:533.6.048.2	8	533.693.9/Thin cross section/:533.693.9/Ogee/:533.6.013.12:001.2:533.6.055:533.6.011.5	14
533.693.3:533.695.12:533.6.011.5	12	533.693.9/Thin cross section/:533.693.9/Ogee/:533.6.041/1.2/:533.6.013.412:001.4:533.6.071:533.6.011.34/5	15
		533.693.9/629.135.2:532.6.011.32/:533.693.9/Thin cross section/:533.693.9/Ogee/:533.6.013.124:533.694.24/Trailing edge/Sweep back/	16
		533.693.9/629.135.2:532.6.011.32/:533.693.9/Thin cross section/:533.693.9/Ogee/:533.6.013.13:533.694.24/Trailing edge/Sweep back/	17
		533.693.9/629.135.2:532.6.011.32/:533.693.9/Thin cross section/:533.693.9/Ogee/:533.6.013.152:533.694.24/Trailing edge flap/Sweep back/	18
		533.693.9/629.135.2:532.6.011.32/:533.693.9/Thin cross section/:533.693.9/Ogee/:533.6.013.412:533.694.24/Trailing edge flap/Sweep back/	19
		533.693.9/629.135.2:532.6.011.5/:533.693.9/Thin cross section/:533.6.043.12:533.6.013.124	20

430

a	b	c	d
		533.693.9/629.137:656.7: 533.6.011.32/:533.693.3 /Thick cross section/:533. 693.4:533.6.048.2:533.6. 043	21

622 Annotation

1 There is considerable variation in the sequence of the subjects according to the CC number and that accrding to UDC number in the catalogue cards supplied with the technical reports.

2 The sequence of the subjects according to the UDC number constructed to be as coextensive as possible with the facet analysis of the subject of each technical report is more or less similar to the sequence of the subjects according to CC numbers. In fact, there is only one variation, and that is due to the use of the alphabetical device in UDC to sharpen an isolate idea.

7 CONCLUSION

1 The subjects going with a Basic Subject should have the necessary distinctive schedules of special isolates. The indicator digit connecting the components should be effectively used for indicating either the nature of the component to which it is prefixed or the nature of the "relation" between the components it connects. It is not helpful, both from the point of view of the idea plane and

also from that of the notational plane to use extensively a compound subject as if it were an isolate, using the colon device.

2 The facet analysis based on the postulates, canons and principles of the General Theory of the Library Classification gives a consistent pattern of analysis of subjects helpful to the majority of readers. Constructing the UDC number on the basis of such a facet analysis is not only possible but it also gives

21 A class number more coextensive with each of the subject;

22 A more helpful arrangement of the subjects; and

23 A method by which the UDC Number can be made more compatible with the CC Number.

3 Basing itself on a good theory of classification, it would provide UDC with a basic foundation to guide its development on systematic and desirable lines, if the methodology for the design of the scheme itself is based on a set of sound postulates and principles, instead of using them only for classifying a subject.

4 Without such a theoretical basis for the consistent analysis of the subject and for classifying

41 The UDC Class Number will not always be coextensive with the corresponding subject of the document; and

42 Related subjects get more widely scattered than is desirable.

5 A general theory of library classification constructed out of a hierarchy of guiding principles and postulates (.4) is available for use by any scheme for classification -- to base its methodology for design as well as for classifying. As has already been mentioned in Sec 3, the self perpetuation and resilience of a scheme for classification in the context of a dynamic universe of subjects and psychology of readers, requires such a built-in capacity for development. Without this built-in capacity UDC cannot be developed into a universal scheme for classification.

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GEOLOGY IN CC AND UDC SCHEDULES.

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CC places Geology among Biological Sciences and UDC places it among the physical and Chemical Sciences in their respective schedule of main subjects. The latest versions of CC and UDC have accommodated many new adjunct main subjects, such as Geophysics and Geochemistry. The hierarchical structure of subjects going with Geology are represented more coextensively in CC than in UDC. Arrangement of compound subjects in both the schemes conforms to the Principles for Helpful Sequence. Any deviation from postulates and principles in respect of sequence of facets in compound subjects in UDC number is due to its enumerative DC Core.

1 SCOPE OF THE PAPER

This paper presents a comparative study of the latest versions of Colon Classification and Universal Decimal Classification for subjects going with the Basic Subject Geology (2,10). The comparison is made in respect of conformity or otherwise, to the canons and principles for work in the idea plane, enunciated in Ranganathan's theory of library classification (7).

2 GEOLOGY AND RELATED SUBJECTS

21 Definition and Scope

"Geology" is the study of earth. Its scope is as follows (1): It is one of the several related subjects commonly grouped as Geoscience. Geologists are concerned primarily with rocks that make up the outerpart of the earth. An understanding of these materials involves principles of physics and chemistry; geophysics and geochemistry, now important scientific disciplines in their own right, are adjuncts to geology and cover the study of the visible and deeper parts of the earth. The study and mapping of surface forms are shared by geology with geodesy. The study of the earth's waters related to geologic processes is shared by hydrology; study of records left by animals and plants that lived in past ages is a part of geology, though it involves many fundamental aspects of the biological sciences.

22 Branches of Geology

The following are the main branches of Geology:

1 Physical geology

11 Mineralogy, study and classification of minerals;

12 Petrology, study of rocks, their physical and chemical properties and their modes of origin;

13 Weathering and erosion, study of processes that alter exposed bed-rock and shape

435

land forms;

14 Sedimentation, origin and deposition of modern sediments;

15 Structural geology, study of geometry of rock masses with emphasis on crystal deformation;

16 Economic geology, application of geologic knowledge and principles to solution of practical problems;

2 Historical Geology

21 Stratigraphy, systematic study of bedded rocks and their relations in time;

22 Paleontology, study of fossils and their locations in a sequence of bedded rocks;

3 Geologic mapping, graphic representation of bedrock units defined by physical characteristics and geologic age.

3 REPRESENTATION OF "GEOLOGY" IN CC AND UDC

31 Schedule of Main Subjects

The following table presents a portion of the schedule of main subjects of CC, and a portion of the outline of the main divisions in UDC in columns (b) and (c) respectively.

SN	Schedule of (MS) in CC	Schedule of (MS) in UDC
(a)	(b)	(c)
1	A Natural sciences	5 Mathematics and Natural sciences
2	B Mathematics	51 Mathematics
3	C Physics	52 Astronomy. Surveying geology

436

SN	Schedule of (MS) in CC	Schedule of (MS) in UDC
(a)	(b)	(c)
4	D Engineering	53 Physics and mechanics
5	E Chemistry	54 Chemistry. Crystallography. Mineralogy
6	F Technology	55 Geology. Meteorology
7	G Biology	56 Paleontology
8	HUB Geodesy	57 Biology. Anthropology
9	HV Geophysics	58 Botany
10	HVT Geochemistry	59 Zoology
11	HX Mining	
12	I Botany	
13	K Zoology	
13	KX Animal husbandry	
15	L Medicine	

311 Annotation

CC has placed "Geology" between the main subjects "G Biology" and "I Botany". That is, CC places it among Biological Sciences. The reason for this is that earth is the habitat of all living organism studied in biology. Geology is the study of the properties of this habitat of living organism. Therefore, it should come later than the study of the living organism -- that is, Biology itself. On the other hand, UDC places "Geology" between "54 Chemistry" and "56 Paleontology". This is because it has taken Geology as a subject with affinity to the Physical and Chemical sciences.

437

32 Schedule of Non-Main Basic Subjects

The following table presents the schedule of non-main subjects of the Main Subject H Geology in CC, and the subjects in the array of Order 1 division of the subject "55 Geology" in UDC.

SN	Non-Main (BS) of H Geology and adjunct (MS)		Array of Order 1 of 55 Geology	
1	HOZ	Physical geology	550	Auxiliary sciences (550.1 Physiography; 550.2 Geoastronomy 550.3 Geophysics; 550.4 Geochemistry; 550.7 Geobiology)
2	H1	Mineralogy		
3	H2	Petrology		
4	H3	Structural geology		
5	H4	Geomorphology		
6	H42	Historical geology		
7	H5	Stratigraphy	551	General geology (Meterology Climatology Historical geology Stratigraphy Palaeogeography)
8	H6	Palaeonotology		
9	H7	Economic geology		
10	HV2Z	Internal geodynamics		
11	HV3	Volcanology	552	Petrography
12	HV35	Geyser	553	Economic geology and Mineralogy, (Formation and deposits of minerals)
13	HV4	Seismology		
14	HV81	Metereology		
15	HV83	Aeronomy		
16	HV86	Ionosphere		

321 Annotation

The schedule in CC seems to be helpful in understanding the structure of the subject. For, it groups the traditional divisions of Geology under two partial comprehensions -- namely, HOZ Physical geology and H4Z Historical geology. This is followed by the non-

main basic subjects going with the adjunct Main Subjects. The latest version of CC has shifted Internal geodynamics -- that is, Volcano, Geyser, and Earthquake -- from Pure Geology to "HV Geophysics". This reflects the recent developments of the subject. Similarly, 'Geomorphology' and 'Meteorology' are shifted from 'U Geography' to 'HV Geophysics'. Compared with CC, the structure of the UDC schedule does not represent the subordinate and coordinate relations of the subjects coextensively. Scatter of related subjects is indicated by a number of cross references. For example, from 'Geophysics', cross-references are given to 'Internal and external geodynamics'and 'Physical geology and Meteorology'. Further, the schedule for Geology has excluded its traditional subdivisions (as indicated in Sec 12). This violates the Canon of Helpful Sequence (3), and the Canons for Filiatory Sequence (4).

4 SCHEDULE FOR COMPOUND SUBJECTS

A compound subject is made up of a Basic Subject and one or more isolate ideas. The Arrangement of Compound Subjects in a sequence helpful to a majority of readers is generally based on certain guiding principles. Ranganathan has formulated eighteen guiding principles to determine the helpful sequence of Compound Subjects (8). We shall examine, as a case study, the different principles used in the design of schedules for Compound Subjects going with the Basic Subject Petrology, in CC and UDC.

42 Principles for Helpful Sequence Used in CC and UDC in Petrology

The following table presents data about the use of the different Principles for Helpful Sequence used in the schedule for Compound Subjects going with the Basic Subject 'Petrology'.

Schedule of	CC		UDC	
	Characte-ristic	Principle used	Characte-ristic	Principle used
Varieties of Rocks				
Array of ORDER 1	By Mode of Formation	Increasing Complexity	By Mode of Formation	Increasing Complexity
Igneous rocks*				
Array of ORDER 2	By Depth of Formation	Increasing Quantity	By Percentage of Quartz	Increasing Quantity
Array of ORDER 3	By Percent-age of Quartz	Increasing Quantity	By Depth of Formation	Decreasing Quantity
Metamorphic rocks*				
Array of ORDER 2	By Hydrosta-tic pressure needed for formation	Decreasing Quantity	By Hydrostatic pressure needed for formation	Decreasing Quantity

Schedule of	CC		UDC	
	Characteristic	Principle used	Characteristic	Principle used
Array of ORDER 3	By Load pressure and Temperature	Increasing Quantity	By Load pressure and Temperature	Increasing Quantity
Sedimentary rocks*				
Array of ORDER 2	By Strength of Texture	Increasing Quantity	By Strength of Texture	Increasing Quantity
Clastic rocks+				
Array of ORDER 3	By Grain Size	Decreasing Quantity	By Grain Size	Decreasing Quantity
Chemical rocks+				
Array of ORDER 3	By Origin	Increasing Concreteness	By Origin	Increasing Concreteness

* Isolates in Array of Order 1 + Isolates in Array of Order 2

43 Annotation

The sequence of Compound Subjects and the principles used to arrange them in different arrays are more or less the same both in CC and UDC. But, in respect of "Igneous rocks", there is a change in the sequence of the characteristics used. CC applies the characteristics in the following sequence:

By Depth of formation

By Percentage of quartz in rocks.

Whereas, UDC applies these characteristics in the reverse sequence. Further, UDC uses the "Principle of Decreasing Quantity" (5), for subjects derived on the basis of the characteristic "By Depth of formation" in array of Order 3 of igneous rocks. Whereas CC uses the "Principle of Increasing Quantity" (5) to arrange the subjects derived on the basis of the same characteristic in array of Order 2 of Igneous rocks.

5 SEQUENCE OF FACETS IN COMPOUND SUBJECTS

51 Principles for Sequence of Facets

Let us examine the sequence of isolate facets in the Compound Subjects going with the Basic Subject Petrology in CC and UDC. The following table presents the name of subjects, sequence of facets derived on the basis of a set of postulates (9), the sequence of facets according to the CC number, and the sequence of facets according to the UDC number.

SN	Subject	Postulates	Sequence of Facets according to CC Number	Sequence of Facets according to UDC Number
1	Methods of computing chemical composition of silicaous rocks	Petrology. Siliceous rocks. Chemical composition. Computation. Method.	H2,3541;82E:b1;0a Petrology. Siliceous rocks. Chemical composition. Computation. Method.	552.55:552.26 Petrology. Siliceous rocks. Chemical composition. Computation. Method.
2	Microscopic determination of minerals in Alkali granite rocks.	Petrology. Alkali granite rocks. Mineral constituents. Determination. Method. Microscopic.	H2,1731,(H1);b6;a91 Petrology. Alkali granite rocks, Mineral constituent. Determination. Method. Microscopic.	552.331.1:552.121 Petrology. Alkali granite rocks. Determination. Microscopic Method. Mineral constituents

52 Annotation

It may be seen from the above table that CC and UDC numbers generally conform to the sequence of facets derived on the basis of Postulates (9) and Wall-Picture Principle (6). However, there are deviations in UDC. In example 2, the "Mineral constituents" is placed after the Method facet. But according to the Postulates and the Wall-Picture Principle, the "Mineral constituent" should precede the facet "Determination". This is largely due to the enumerative DC core around which the

UDC schedules have been built.

6 CONCLUSION

This paper has only demonstrated a way of comparing two schemes for library classification, based on a set of normative principles formulated in the theory of library classification. It may be observed that both CC and UDC have been guided by these principles. As far as the schedules for the subjects going with "Geology" is concerned, UDC has given a more detailed schedule than CC. But its scope has been restricted as stated in Sec 2. The CC, on the other hand, has provided for many devices in its schedules. But, considering from the point of view of subjects being published in the form of books today, both CC and UDC require considerable revision and updating.

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CLASSIFICATION OF BOOKS ON DISEASE IN MEDICINE: A COMPARATIVE STUDY OF CC AND UDC CLASS NUMBERS.

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[Colon Classification and Universal Decimal Classification numbers for an assorted sample of books listed in the BNB (1969) on compound subjects going with the host subject "Medicine, Disease" have been compared. The criteria chosen for comparison are coextensiveness, brevity in notation, similarity of pattern in the sequence of components in compound facets, similarity of pattern of the sequence of facets of all compound subjects, and helpfulness of the overall sequence of compound subjects. The essential merit of CC over UDC is that it is guided by a dynamic theory of library classification, consisting of a hierarchy of guiding principles. This reduces to a minimum, the incidence of flair and judgement in classifying. On the other hand UDC is guided by certain rules which give scope for alternative class numbers, often catching the classifier in two minds as it were].

0 INTRODUCTION

01 Schemes for Comparison

This paper reports on a comparative study of the relative efficiency of two schemes for library classification, namely, Colon Classification (=CC)

and Universal Decimal Classification (=UDC). The latest available versions of both the schemes have been used (3, 13). The comparison is largely restricted to the study of practical classification of books. Further, this paper presents a methodology for comparison of the class numbers.

02 Sample of Books.

An assorted sample of one hundred books listed in the British national bibliography (=BNB) (1969) was selected. Each of them embody subjects going with the host subject "Medicine, Disease". Each book is classified by CC and UDC.

03 Procedure for Classifying

BNB gives feature headings more or less coextensively expressing the subject of the book listed in it. This helps in the facet analysis of the subject of the book. The steps in the postulational method of classifying the subject of the book has been adopted for assigning the CC and UDC numbers (11).

04 Criteria Used for Comparison

The CC and UDC numbers are compared in respect of the following attributes:

1 Coextensiveness;

2 Brevity in notation;

3 Similarity in the pattern of sequence of the components of compound facets in all compound subjects;

4 Similarity in the pattern of sequence of facets in all compound subjects; and

5 Helpfulness to specialists of the overall sequence of compound subjects.

1 SOME CHARACTERISTICS OF THE SAMPLE SUBJECTS

11 Distribution of Books According to the Number of Facets

The hundred books selected were grouped according to the number of facets incident in the compound subjects. In the counting of the facets, the Basic Subject and the isolate ideas have each been taken as a facet. Since the compound subjects chosen as a sample go with the two-faceted subject "Medicine, Disease", the incidence of one-faceted subject -- that is, Basic Subject alone -- does not occur in the sample. Table 1 presents data about the distribution of books according to the number of facets incident in their respective subjects.

111 Table 1. Distribution by Number of Facets

SN	N of facets	N of books
1	2	21
2	3	50
3	4	23
4	5	5
5	6	1
		Total 100

112 Annotation

Ninety four per cent of the books selected embody subjects have not more than four facets.

12 Kinds of Facets

Table 2 presents the distribution of documents according to the kinds of facets incident in the respective compound subjects.

121 Table 2. Distribution by Kind of Facet

SN	N of facets	Kinds of facets	N of documents
1	2	Medicine, Disease	21
2	3	Medicine, Disease, Handling	9
3	3	Medicine, Disease, Stage	4
4	3	Medicine, Organ, Disease	37
5	4	Medicine, Disease, Handling, Agent	1
6	4	Medicine, Organ, Disease, Handling	14
7	4	Medicine, Organ, Disease, Stage	7
8	4	Medicine, Organ of remove 1, Organ of remove 2, Disease	1
9	5	Medicine, Organ, Disease, Handling, Agent	3
10	5	Medicine, Organ, Disease Stage, Handling	1
11	5	Medicine, Organ of remove 1, Organ of remove 2, Disease, Handling	1
12	6	Medicine, Organ, Disease, Stage, Handling, Agent	1
		Total	100

449

122 Annotation

The sample represents an assortment of different kinds of facets and combination of facets.

13 Intension of Isolate Ideas in Facets

Table 3 presents data about the distribution of the books according to the kinds of facets and the intension -- that is, the order of the array -- of the isolate ideas forming isolate facets in the compound subjects.

(For Tabe 3 See next page)

132 Annotation

1 The distribution of the subjects having isolate ideas of great intension lies largely among three and four faceted subjects.

2 The three faceted subjects have a higher incidence of isolates of greater intension in all the facets than the four faceted subjects.

3 The organ facet and the disease facet have a higher incidence of isolate ideas of intension upto array or order 3, in comparison with the other three facets.

4 However, the disease facet shows a higher incidence of isolate ideas of greater intension than the organ facet.

5 In fact, the range of variation of order of array is 1 to 7 in disease facet, where as it is 1 to 5 in organ facet.

131 Table 3. Intension of Isolate Ideas in Facets

N of facets	N of documents	Kind of facets													
		Organ of Removal						Disease							
		Absent	Isolate idea of array of order					Isolate idea of array of order							
			1	2	3	4	5	1	2	3	4	5	6	7	
a	b	c	d	e	f	g	h	j	k	l	m	n	p	q	
2	21	21	-	-	-	-	-	2	6	8	4	1	-	-	
3	50	13	2	20	7	7	1	13	4	13	6	6	7	1	
4	23	1	2	16	3*	1	-	18	2	2	1	-	-	-	
5	5	1*	1*	1	-	2	1	-	2	3	-	-	-	-	
6	1	-	-	-	-	1	-	-	-	1	-	-	-	-	
Total	100	35	5	37	10	11	2	33	14	27	11	7	7	1	

*Indicates isolate ideas ocurring in Level 2 of Organ facet

Continued —

131 Table 3. Intension of Isolate Ideas in Facets (Continued)

N of facets	N of documents	Kind of Facets								
		Stage				Handling			Agent	
		Absent	Isolate idea of array of order			Absent	Isolate idea of array of order		Absent	Isolate idea of array of order
			1	2	3		1	2		1
a	b	r	s	t	u	v	w	x	y	z
2	21	21	-	-	-	21	-	-	21	-
3	50	46	2	1	1	41	8	1	50	-
4	23	16	7	-	-	9	14	-	22	1
5	5	4	-	-	1	-	5	-	2	3
6	1	-	1	-	-	-	1	-	-	1
Total	100	87	10	1	2	71	28	1	95	5

14 Compound Isolate Facet

Table 4 presents data about the incidence of compound isolates in the organ and disease facets of the compound subject.

141 Table 4. Incidence of Compound Isolates

SN	N of facets	Number of documents having Compound Isolates in	
		Organ Facet	Disease Facet
1	2	-	1
2	3	4	10
3	4	-	1
4	5	1	-
5	6	-	-

142 Annotation

The other facets -- namely, Stage, Handling and Agent -- did not have any compound isolate.

2/7 COMPARATIVE STUDY

2 CO-EXTENSIVENESS

21 Definition

Co-extensiveness is the expression in a class number of the measure of incidence of each of the relevant characteristics of the subject embodied in the document (5, 10). A subject is an organised systematised body of ideas. It may consist of one idea or a combination of ideas. The latter is the case with a majority of the subjects sought by readers. A co-extensive representation of a subject requires, as a prerequisite, the

453

1 Recognition of each of the component ideas in the subject; and

2 Determination of the degree of interrelation among the components. For, two subjects in the universe of subjects may differ from each other in respect of

1 The component ideas; and

2 The interrelation among the component ideas even if the latter are the same in the two subjects.

22 Measure of Co-extensiveness of Class Number

Table 5 presents data on the per centage of co-extensive class numbers given by CC and UDC. They are grouped by the number of facets present in the subject.

(For Table 5 See next page)

23 Annotation

CC is able to give co-extensive class numbers to all the 100 subjects in the sample. But the UDC is able to give co-extensive class numbers only to 25 subjects. Out of the 75 non-coextensive UDC numbers, 69 do not indicate the interrelation between the component ideas in the compound subject, although each of the UDC numbers represents all the component ideas in the corresponding subject. This is largely due to the UDC not having prescribed a distinctive indicator digit to each of the different kinds of interrelation between the component ideas of a

221 Table 5. Co-extensiveness of Class Number

SN	N of facets	N of documents	N of Co-extensive Class Numbers in		N of Class Numbers not indicating			
					Component ideas in		Interrelation of Component ideas in	
			CC	UDC	CC	UDC	CC	UDC
a	b	c	d	e	f	g	h	j
1	1	-	-	-	-	-	-	-
2	2	21	21	8	-	3	-	10
3	3	50	50	12	-	2	-	36
4	4	23	23	5	-	1	-	17
5	5	5	5	-	-	-	-	5
6	6	1	1	-	-	-	-	1
	Total	100	100	25	-	6	-	69

subject. For example, the same indicator digit " : " (colon) is used to indicate different kinds of relation -- such as, Phase, Facet, and Speciator -- as illustrated in the example presented in Table 6.

231 Table 6. Homonymous Use of the Digit ":" (colon)

SN	UDC Number	Subject	":" indicates	CC Number
1	612.8:616.988	Physiology of the human nervous system influenced by Virus disease	Phase relation	L,7;3&L;424
2	616-009.7:611.92	Facial pain	Facet relation	L,181;4k5
3	616.155:616.39	Anemia caused by nutritional deficiency	Speciator relation	L,35;4z31-4a (L;462)

2 Similarly the indicator digit " - " (hyphen) in UDC does not distinctively indicate the interrelation between two components. It is used to indicate facet relation as well as speciator relation, as illustrated in the examples in Table 7.

232 Table 7. Homonymous Use of Digit "-" (hyphen)

SN	UDC Number	Subject	"-" indicates	CC Number
1	616-056.7	Hereditary disease	Speciator relation	L;46
2	616-08	Treatment of disease	Facet relation	L;4:6

456

3 Such use of indicator digits leads to homonymous class numbers. UDC can avoid the incidence of homonym, which is fatal in a classificatory language of ordinal numbers, if and only if, it prescribes distinctive indicator digits to each of the different kinds of interrelation between the component ideas in a subject in the universe of subjects, recognised in the theory of library classification, from time to time. CC is able to give co-extensive class number to each and every subject in the universe of subjects primarily because it has provided distinctive indicator digits to each kind of interrelation recognised so far among the component ideas in a subject (7).

3 BREVITY OF NOTATION

31 Relativity in the Measurement of Brevity

Brevity of notation denotes "the economy of length in class number -- that is, economy in the number of digits in a class number". The length of a class number should be measured in relation to the co-extensiveness of the class number. It implies that the economy in the number of digits should be effected in each component number of a class number. This is denoted by the term 'Relativity' in the theory of library classification. CC and UDC numbers for the sample of 100 subjects have been compared in respect of relativity in notation.

32 Number of Facets and Brevity

Table 8 presents data on the facet-wise distribution of the number of digits in the CC and UDC numbers.

321 Table 8. Number of digits

SN	N of facets	N of documents	Number of digits in the CC Number			UDC Number		
			Max	Min	Average	Max	Min	Average
a	b	c	d	e	f	g	h	j
1	1	-	-	-	-	-	-	-
2	2	21	9	4	6	13	6	9
3	3	50	18	5	9	20	5	11
4	4	23	15	7	9	17	5	9
5	5	5	17	12	14	18	14	16
6	6	1	-	-	16	-	-	23
7	All taken together	100	18	5	9	20	5	10

322 Annotation

1 The number of digits in an UDC number on an average is greater than that in a CC number in all the cases.

2 The average number of digits in the CC number for three-faceted and four-faceted subjects is the same. It may appear to be an anomaly at the superficial level. However, as shown in Table 3 in Sec 13;

the incidence of isolate ideas of greater intension is more in the three-faceted subjects than in four-faceted subjects. According to the Canon of Relativity (9), there should be a digit to represent the incidence of the order -- that is, the number of characteristics used to derive that isolate idea. CC conforms to the Canon of Relativity. And in Table 4 in Sec 14, it has been shown that there is a higher incidence of compound isolates in the three-faceted subjects than in the four-faceted ones. These factors naturally lengthen the class numbers. It may also be noted that the range between the maximum number of digits and minimum number of digits in a class number is 18 and 5 respectively in three-faceted subjects and 15 and 7 in four-faceted subjects. This is also indicative of the intension of the isolate ideas occurring in the facets of the three-faceted subjects.

3 The average number of digits for three-faceted subjects is 11 and four-faceted subjects is 9. This again appears to be an anomaly, but as stated above, this is due to the incidence of isolate ideas of greater intension in three-faceted subjects.

4 There is a marked increase in the average number of digits in CC numbers from four-faceted subjects to five-faceted subjects. This may be due to the isolate ideas occurring in facets of the subjects being of great intension and also due to the number of class numbers for five-faceted subjects being small. This is evident from the fact

that the maximum number of digits in the CC number is 17 and minimum 12 in five-faceted subjects.

5 The average number of digits in the UDC number shows a steep rise in respect of five-faceted and six-faceted subjects. This is largely due to UDC not having provided a schedule of special isolates needed for compound subjects having 5 or more facets; instead it has prescribed the use of devices such as special auxiliary device, colon device, and alphabetical device.

6 These devices use several digits as 'dummy' digits. For example, the special auxiliary "-006.6" contains the indicator digit "-" and the two dummy digits "00".

7 Further, while classifying by UDC, whenever there was a need to compound special auxiliaries such as for the subject "Medicine, Disease, Cancer, Diagnosis", the Main number 616 is not repeated. The UDC class number for the subject is 616-006.6-07. Otherwise, it would have been 616-006.6:616-07.

8 UDC can effect considerable economy in the length of the class number if it builds into its design some of the analytico-synthetic features of CC and uses a versatile notational system.

4 SEQUENCE OF COMPONENTS IN A COMPOUND ISOLATE

It is helpful to a majority among readers if the component ideas in a compound isolate are arranged on the basis of a set of guiding principles.

For, it would secure consistent sequence among the components (12). In the compound subjects under consideration, compound isolate is incident seventeen times -- 5 in organ facet and 12 in disease facet. In determining the sequence of the components in a compound isolate, CC usually uses the Wall-Picture Principle (6). The quasi-isolates on the basis of which speciators are derived are also arranged according to the Wall-Picture Principle. In synthesising the compound isolate, CC uses the principle "Earlier in the schedule, later in the compound isolate". Thus in CC, the classifier is automatically guided by the schedule itself in constructing compound isolate numbers. This secures similarity in pattern of the sequence of components in a compound isolate. On the other hand, UDC does not prescribe any particular sequence for the components in a compound isolate. This by itself may lead to an inconsistent sequence. For, then the classifier has to use his flair and judgement in determining the sequence of components in each and every case because the schedule does not have a built-in mechanism. However, he can use a guiding principle such as the Wall-Picture Principle, to secure a consistent sequence.

5 SEQUENCE OF FACETS

50 Consistent Sequence of Facets

It has been shown that it is helpful to a majority among readers, if a scheme for classification

gives class numbers to compound subjects in such a way that an overall consistent pattern is followed in the sequence of facets in compound subjects going with a basic subject (12). Both CC and UDC numbers exhibit a consistent pattern of sequence of facets in the hundred compound subjects chosen as sample.

51 Sequence of Facets in CC

The sequence of facets in CC numbers, in general, is "Medicine, Organ, Disease, Stage, Handling, Agent". This sequence is determined on the basis of the Postulate of Fundamental Categories, Postulate of Sequence, and the Wall Picture Principle. This, in general, conforms to the Postulate of Absolute Syntax of Ideas in a compound subject (8).

52 Sequence of Facets in UDC

The sequence of facets in UDC numbers, in general, is "Medicine, Disease, Organ, Stage, Handling, Agent". This sequence is based on the Dewey Decimal Classification with some modifications. However, it does not conform to the theory of UDC, as enunciated by the "Guide to UDC" (2). For, the 'Standard Formula for Citation Order' suggests the sequence "Medicine, Circulatory system-Blood, Disease-Coagulation". But the UDC number for this subject as enumerated in the schedule is 616.151.5. The implied sequence of facets is "Medicine, Disease, Circulatory System, Blood, Physical properties-

coagulation". Further, UDC is not able to maintain this preferred sequence when a compound subject presents an organ facet which is not enumerated in the schedule for disease. The number for the organ facet may have to be taken from the schedule for Anatomy and synthesised as shown in the following example "616-009.7:611.92 Medicine, Disease, Pain, Face". However, this may be got over by using the intercalation device "/ /". Thus, 61/611.92/6-009.7. The argument primarily put forth in favour of the sequence of facets implied in the UDC schedule is that such a sequence is preferred by teachers and students of schools of medicine and also in the presentation of the text in the text-books on Medicine. Probably, this is due to the effect of academic curriculum, tradition, etc. However, it is evident from the experience of documentation service to specialists and research workers in Medicine, the majority prefer the sequence suggested by the 'standard formula for citation order', which is the same as that derived by the Postulate of Fundamental Categories and the Wall Picture Principle. The sequence of facets of subject preferred by medical scientists like Hans Selye, independent of theory of library classification, supports this view (4). Thus, in general, the sequence of facets in CC numbers is more helpful than that in UDC.

6 HELPFULNESS OF THE OVERALL SEQUENCE OF SUBJECTS

CC follows the sequence "general to specific", that is the Principle of Increasing Concreteness in

the arrangement of subjects. It arranges all kinds of diseases affecting the whole body together and arranges all the diseases affecting specific organs together. The former group of subjects is placed earlier to the latter. Further, CC provides for grouping compound subjects under Specials, Environment, and Systems Basic Subjects whenever needed.

On the other hand, in the UDC there appears to be no principle consistently followed although the Principle of General to Specific is taken as the guiding principle for arrangement (3). For, it places some of the diseases which affect the whole body at the beginning and some others at the end, interpolating in-between these two ends subjects dealing with different kinds of diseases of the organs of the human body. Thus, this sequence is obviously not general to specific as shown in the following examples.

616 Medicine, Disease

616-009.7:611.92 Medicine, Disease, Pain, Face

616-056.7 Medicine, Disease-hereditary and familial disease

616.3 Medicine, Disease, Digestive system

616.31-089 Medicine, Disease, Mouth, Surgical operation

616.89:616 Medicine, Disease, Psychosomatic aspects

616.988 Medicine, Disease, Virus

617.7 Medicine, Surgery, Opthalmology

464

Further, there is no separation of compound subjects going respectively with Specials, Environment, and Systems Basic Subjects as they have been treated as special auxiliaries. Further, the helpfulness is impaired because of the indiscriminate permutation of components of class numbers as in the case of the Colon Device and not fixing a definite ordinal value for the different indicator digits used.

7 THEORY TO GUIDE UDC

Many of the merits and demerits of the CC and UDC are due to the essential features involved in the design of the respective schemes. The CC is guided by a dynamic theory of library classification based on a hierarchy of guiding principles attempting to keep pace with the structure and development of the universe of subjects. Whereas the UDC has attempted to veneer the enumerative DC core with some analytico synthetic feature, only partially guided by ad hoc decisions. The very design of it leads to inconsistency in practical classification often resulting in unhelpful sequence of subjects. Therefore, it is necessary for the design and development of UDC schedules and the construction of UDC numbers to evolve a set of guiding principles. The Guide to UDC (1) has done some groundwork in this respect.

8 FURTHER WORK TO BE DONE

As stated earlier, this paper has attempted a method of comparing CC and UDC class numbers

for an assorted sample of 100 subjects of books, largely as a demonstration of a methodology of comparing two schemes for classification. In order to arrive at a deeper and more generalised conclusions, a larger number of documents should be taken as sample. The sample should include not only whole books but also micro-documents -- that is, articles in learned periodicals, research reports, case studies etc.

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466

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TREND OF RESEARCH IN NOTATIONAL SYSTEM FOR LIBRARY CLASSIFICATION, WITH PARTICULAR REFERENCE TO THE COLON CLASSIFICATION.

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More than two decades ago, Ranganathan wrote that is only by breaking rigidity in notation that library classification can survive and efficiently meet the developments in the universe of subjects. The notational system must have the capacity to implement the findings and decisions of the idea plane. The work in and findings of, the idea plane is to be implemented by any species of classification. Therefore, the capacity of the notational system to implement the findings of the idea plane can be a measure of the efficiency of two schemes for classification. With particular reference to the notational system of the Colon Classification, the following points are discussed as future requirements: (1) Accommodation of new Main Subjects in Sector (S-a); (2) Creation of sectors earlier to (S-a) for accommodating new Main subjects, one method giving 265 coordinate Main Subjects numbers and another method giving over 3,400 Main Subject numbers, in either case no one number having more than three digits; (3) Extrapolation in any array earlier to "a", one method giving 265 isolate numbers and another method giving 53 isolate numbers, in either case no one isolate number having more than three digits; (4) Problems in using "Z" for Partial Comprehension; (5) Helpfulness of having different indicator digits for the different manifestations of Matter; whether it is necessary to deem a "Property" or a "Method"

as a manifestation of Matter; (6) Helpfulness of having different indicator digits for the different Devices; (7) Preparation of common schedule of ideas for use as isolate, speciator, and for array division in the scheme for classification of a particular subject or in schemes for different subjects, wherever possible; and (8) Mnemonics 7.

Abbreviations Used:

CC = Colon Classification (IN) = Isolate Number
(CN)= Class Number (MS) = Main Subject

0 INTRODUCTION

01 Planes of Work

The need for and helpfulness of basing the design and development of a scheme for classification and classifying on a sound and dynamic general theory of library classification have been dealt with in other papers (3,4,5,34). The General Theory of Library Classification developed in India (31) is based on a hierarchy of guiding principles and postulates. Its immense helpfulness in the design and development of schemes for classification and in classifying has been amply demonstrated in practice. This theory recommends that the work of classification be deemed to belong to three planes of work, namely, Idea plane, Verbal plane, and Notational plane.

02 Idea Plane and Notational Plane

In this functional division of the work of classification, the work in the idea plane is assigned paramountcy. The notational plane is to implement the findings and decisions of the idea

plane. The work in the idea plane consists essentially of examining the attributes of component ideas of subjects, the nature of the interrelation among the component ideas in the different patterns of their combination to form subjects, and prescribing a sequence of arrangement of the components of subjects and also among subjects that is helpful to a majority of readers. In turn, the work in the idea plane is based on the findings of studies of the relevant attributes of the universe of subjects and psychology of readers. Thus, the work to be done in the idea plane holds good whatever may be the model or species of classification -- purely enumerative, or almost faceted, or rigidly faceted, or freely-faceted -- that is to be designed. Since the notational plane has to implement the findings and decisions of the idea plane, a discussion of the requirements of the notational plane in classification should be of relevance to any species of classification (7,9,33).

021 Work in the Notational Plane

More than two decades ago, Ranganathan wrote "... It is only by breaking rigidity in notation that classification can survive and escape being snowed down under by the downpour of specific subjects in the field of knowledge. The whole history of classification is a history of breaking rigidity [in notation]" (25). He has reiterated this in a paper to this seminar (Paper CA). Since the work in the idea plane is common for all schemes for library classification, the main difference among schemes for library classification lies in the capacity of their respective notational systems to

implement the findings of the idea plane. In other words, two schemes for classification can be compared on their respective capacity to implement the findings of the idea plane.

03 Scope of the Paper

This paper discusses some future requirements of the notational system in a scheme for library classification. For convenience, the most evolved notational system -- that is, the notational system of CC -- is taken up for consideration. Most of the ideas presented have been "played with" in one manner or other in designing depth versions of CC for a variety of subjects during the past five years. Some of the ideas arose while designing computer-aided document finding systems, particularly in synthesising (CN) by computer given kernel terms.

1/2 NEW MAIN SUBJECTS, PARTIAL COMPREHENSIONS, AND SUBJECT BUNDLES

1 DEVELOPMENTS IN THE LAST DECADE

The following table presents data about (MS), Partial Comprehensions, and Subject Bundles in CC, Ed 6 (1960) and ed 7 (in preparation) (1).

SN	Main Subject, etc	Number in CC	
		Ed 6	Ed 7
1	Main Subject	21	76
11	Fused (MS)	-	21
12	Distilled (MS) ..	-	16
13	Other (MS)	21	39
2	Partial Comprehension ..	4	20
3	Subject Bundle	-	12
	Total	25	108

470

11 Annotation

The number of (MS), Partial Comprehensions, and Subject Bundles in CC, ed 7, is over four times that in CC, ed 6, published a decade ago. This trend may continue. The increase in the number of Fused (MS), Distilled (MS), and Subject Bundles emphasises the inter-disciplinary character of the emerging subjects. There may arise other kinds of formation of subjects requiring accommodation in the schedules in juxtaposition to the (MS), Subject Bundles, and Partial Comprehensions.

12 Hospitality of the Scheme for Classification

The new (MS) have to be accommodated in the schedule of (MS) in a sequence more or less helpful to a majority of readers. The Partial Comprehensions of (MS) and Subject Bundles have also to be helpfully accommodated in relation to the (MS). The notational system of the scheme for classification should place the new (MS) etc in the position determined by the idea plane. (See also Paper CD in this volume)

13 Hospitality of CC

At present, in CC, any new (MS) has to be interpolated between "z Generalia" at one end and "Z Law" at the other. The idea plane indicates that "Generalia" is the most general comprehensive subject. Further, the Principle of Increasing Artificiality used in arranging the (MS) in CC from "△ Spiritual experience and mysticism" to "Z Law" indicates that "Law" is the subject of

highest artificiality. The fuller exploitation of the unused numbers in the sector (S-9A) and the use of Empty, and Empty-Emptying digits may suffice for some time. But we have to provide for the future. Already, the need for accommodating (MS) adjunct to "Z Law" has been sensed. The packeted digits can meet the need for extrapolation after "Z" for some time. Therefore, we shall consider the accommodation of new (MS) earlier to "1" and earlier to "a".

14 Interpolation Between "z" and "1"

The digit-combinations now available with ordinal value lying between "z" and "1" are those with "0" as sectorising digit. This will give 265 coordinate digit-combinations in 15 sectors, with no one digit combination having more than 3 digits, as shown in the following table.

SN	Sector (S-)	Numbers		N of (MS) numbers
1	0a	0a, 0b, ... 0y	..	22
2	0za	0za, 0zb, ... 0zy	..	22
3	0z1	0z1, 0z2, ... 0zε	..	8
4	0zA	0zA, 0zB, ... 0zY	..	23
5	00a	00a, 00b, ... 00y	..	22
6	001	001, 002, ... 00ε	..	8
7	00A	00A, 00B, ... 00Y	..	23
8	01	01, 02, ... 08	..	8
9	09a	09a, 09b, ... 09y	..	22
10	091,	091, 092, ... 098	..	8
11	09A	09A, 09B, ... 09Y	..	23

SN	Sector (S-)	Numbers	N of (MS) numbers
12	CA	CA, CB, ... CY	23
13	CZa	CZa, CZb, ... CZy	22
14	CZ1	CZ1, CZ2, ... CZ8	8
15	CZA	CZA, CZB, ... CZY	23
		Total ..	265

It will be noted that here, "C" is used as an Empty digit, just as "z", "9", and "Z" nave been used to create sectors (1C).

15 Use of Sector (S-a)

An examination of the sectors used in the schedule of (MS) indicates that the digits in the sector (S-a) have not been used. In an earlier paper dealing with extrapolation at the beginning of an array, it was pointed out that by depriving the digits in zone (Z-a) of their Anteriorising quality, "extrapolation at the beginning of any array will be facilitated" (11). However, at present, the digits in the sector (S-a) cannot be assigned to (MS) because these (MS) will then get arranged earlier to "z Generalia". This will violate the prescriptions of the idea plane.

151 Shifting of "Generalia"

Without violating the findings of the idea plane, we may prescribe that the first semantically rich digit in the earliest sector of the

notational system be assigned to "Generalia". For example, if we use the digits in the Zone (Z-a) in this way, then we can have 287 co-ordinate numbers in 16 sectors earlier to (S-0a), with no one digit-combination having more than 3 digits, as shown in the following table. In this case, "a" may be assigned to "Generalia".

SN	Sector (S-)	Numbers	N of (MS) numbers
1	a	a, b, ... y	22
2	za	za, zb, ... zy	22
3	zza	zza, zzb, ... zzy	22
4	zz1	zz1, zz2, ... zz8	8
5	zzA	zzA, zzB, ... zzY	23
6	z0a	z0a, z0b, ... z0y	22
7	z01	z01, z02, ... z08	8
8	z0A	z0A, z0B, ... z0Y	23
9	z1	z1, z2, ... z8	8
10	z9a	z9a, z9b, ... z9y	22
11	z91	z91, z92, ... z98	8
12	z9A	z9A, z9B, ... z9Y	23
13	zA	zA, zB, ... zY	23
14	zZa	zZa, zZb, ... zZy	22
15	zZ1	zZ1, zZ2, ... zZ8	8
16	zZA	zZA, zZB, ... zZY	23
		Total ..	287

Thus, we can have 552 (that is, 265+287) new (MS) between "a" and "1".

474

152 No Great Practical Difficulty in Shifting "Generalia"

A shifting of "Generalia", as mentioned above, is not likely to involve large-scale change in (CN) in libraries. For, in general, the number of books in a library assigned to "Generalia" is not large. There may, however, be a larger number of volumes of periodical publications in "Generalia". But, according to a prescription in CC, for economy in notation, the "z" in these (CN) is omitted -- that is, the (CN) starts with a lower case letter, such as "m" or "n" representing an Approach material. Thus, if "a" is assigned to "Generalia", a generalia periodical will now have an "m" as the first three-digits in the (CN). Even if we create Zones with digits of lower ordinal value than "a", then "Generalia" can be assigned the first semantically rich digit in the Zone of the lowest ordinal value.

2 SECTORS WITH DIGITS OF ORDINAL VALUE LESS THAN "a"

21 Law of Symmetry

Packeted notation suggested in 1955 provided for extrapolation beyond "Z" (23). Law of Symmetry suggests that provision for placing (MS) earlier to "a" should be thought of.

22 Three Approaches

Three approaches can be considered for providing extrapolation earlier to "a". They are:

475

1 Use of new set of species of digits -- such as, the alphabets of a natural language.

2 Use of a single new sectorising digit; and

3 Manipulation of existing digits of the notational system of CC.

23 Use of a Set of New Species of Digits

In introducing a set of new species of digits into the notational system, it is to be ensured that the new digits are

1 Fairly widely known;

2 Used more or less universally;

3 Already arranged in a sequence of ordinal value;

4 Fairly easy to write; and

5 Available on typewriters generally.

The notational system of CC is already using the Hindu-Arabic numerals, the letters of the Roman alphabet, and the conventional punctuation marks. These satisfy the conditions mentioned above. The introduction of the letters of the alphabet from another language -- for example, Greek, or Cyrillic, or Sanskrit alphabet -- will not satisfy the conditions mentioned above, although fixing the ordinal values of the digits will not be difficult.

24 Use of a Sectorising Digit

To create sectors earlier to "a", we need a digit which is

1 Semantically empty; and

2 Of ordinal value less than that of "a" to be

476

used as the first digit of each of the sectors. Suppose we use " ↑ " (upward arrow) -- earlier suggested for anteriorising purpose (27) and later withdrawn in favour of " ‘‘ " (double inverted comma)(11), as such a sectorising digit. It will give rise to 15 sectors of 265 coordinate digit combinations in all, with no one digit combination having more than 3 digits, as shown in the following table.

SN	Sector (S-)	Numbers	N of (MS) numbers
1	↑a	↑a, ↑b, ...↑y	22
2	↑za	↑za, ↑zb, ...↑zy	22
3	↑z1	↑z1, ↑z2, ...↑z8	8
4	↑zA	↑zA, ↑zB, ...↑zY	23
5	↑0a	↑0a, ↑0b, ...↑0y	22
6	↑01	↑01, ↑02, ...↑08	8
7	↑0A	↑0A, ↑0B, ...↑0Y	23
8	↑1	↑1, ↑2, ... ↑8	8
9	↑9a	↑9a, ↑9b, ...↑9y	22
10	↑91	↑91, ↑92, ...↑98	8
11	↑9A	↑9A, ↑9B, ...↑9Y	23
12	↑A	↑A, ↑B, ... ↑Y	23
13	↑Za	↑Za, ↑Zb, ...↑Zy	22
14	↑Z1	↑Z1, ↑Z2, ...↑Z8	8
15	↑ZA	↑ZA, ↑ZB, ...↑ZY	23
		Total ..	265

477

Another possible and perhaps a better digit is * (asterisk). It is usually available on typewriters. The upward arrow is not usually available on all the typewriters and in a Class Number, it is less distinctive than the asterisk.

Here, "↑" or "*", as the case may be, would function just as z, 0, 9, and Z are used as Empty digits for sectorising purpose. The consecutive occurrence of "↑ ↑" is avoided for the present.

25 Manipulation of Existing Digits

As mentioned in the preceding section, for creating sectors of ordinal value less than that of " a ", we need as the first digit in each sector a semantically Empty digit and of ordinal value less than that of " a ". Obviously, the existing Empty digits z, 0, 9, and Z of the notational system of CC cannot be used for this pur purpose as each of them has an ordinal value higher than that of " a ". There are, however, thirteen digits in the notational system of CC, each of which is semantically empty by itself and has an ordinal value less than that of " a ". These are ← ") & ' . : ; , - = + → falling in that sequence when arranged in the sequence of increasing ordinal value. Each of these can be used as the first digit to form sectors. Each of them will give rise to 15 sectors with a total of 265 coordinate digit combinations, no one digit combination having more than three digits. Each of the digit combinations will get arranged earlier

to "a". It may also be mentioned here that the use of these same digits as facet indicator, etc in a compound subject will not be a problem. The following table gives an example of such sectors. The " + " (plus) is used as a starter digit in each sector.

SN	Sector (S-)	Numbers	N of (MS) numbers
1	+a	÷a, +b, ... +y	22
2	+za	+za, +zy ... +zY	22
3	+z1	+z1, +z2, ... +z8	8
4	+zA	+zA, +zB, ... +zY	23
5	+0a	+0a, +0b, ... +0y	22
6	+01	+01, +02, ... +08	8
7	+0A	+0A, +0B, ... +0Y	23
8	+1	+1, +2, ... +8	8
9	+9a	+9a, +9b, ... +9y	22
10	+91	+91, +92, ... +98	8
11	+9A	+9A, +9B, ... +9Y	23
12	+A	+A, +B, ... +Y	23
13	+Za	+Za, +Zb, ... +Zy	22
14	+Z1	+Z1, +Z2, ... +Z8	8
15	+ZA	+ZA, +ZB, ... +ZY	23
		Total ..	265

Similarly, with each of the other semantically Empty digits. Thus, we will have 265 co-ordinate digit-combinations in each set, giving a total of 3,445 (= 265 x 13) numbers for assignment to (MS) occurring earlier to " a ". None of

479

the digit-combinations will have more than 3 digits.

251 Advantage

The advantages of the method suggested include the following:

1 No new digit need to be introduced;

2 The ordinal value of the first digits used as sectorising digit is already fixed in the notational system of CC;

3 The number of coordinate digit-combinations is far larger than that obtained by the method suggested in Sec 24. Even if such digits as "←" and "→" are rejected as not usually available on the typewriter, we can still have 2,915 coordinate digit combinations using the remaining 11 digits.

4 Whenever any new indicator digit of ordinal value less than that of "a" is introduced into the notational system of CC, it can be automatically used as a sectorising digit in the manner suggested above; and

5 Some of the digits -- such as , (comma), ; (semi-colon), : (colon), . (dot), ' (single inverted comma) have mnemonic significance as facet indicators in compound subjects. It may be possible to take advantage of this feature in allocating sectors to new (MS) to be placed earlier to "a".

252 Disadvantage

One objection to the above suggestion may be the slight "strangeness" of the (CN) formed

by using these (MS) numbers. Here are some examples:

"a.44	:4.44	,K,54	=b,4
"a;1:3	:D,56'N	,Za;5	=y;4
'2,a.4	;9B,4"a	-X,7'N	+5:3
'8;1:6	;C;z3	-Y,3;5	+B,6;4

But this strangeness will disappear by use. As has already been mentioned, there will be no conflict or confusion of the (CN) for the (MS) with the isolates in compound subjects using the very same sectorising digits as indicator digits.

3 EXTRAPOLATION IN THE ARRAY OF ISOLATES

31 Extrapolation Earlier to "1"

Packeted notation, mentioned earlier, provided for extrapolation in the array of isolates beyond "Z". This having become inadequate for depth classification, a new semantically empty sectorising digit -- namely, "^" (inverted V) has been suggested. It has an ordinal value higher than that of "(" (32). By depriving the digits of (S-a)of their Anteriorising quality and by providing a distinctive digit -- that is, " " "(double inverted comma) -- extrapolation at the beginning of an array earlier to "1", was facilitated (11). Also, fixing a single ordinal value to "0" -- that is, between "z" and " 1" -- instead of its earlier two values, also helped in this extrapolation. Thus, 31 sectors with a total of 552 numbers of coordinate status and

none of which has more than 3 digits, can be placed earlier to "1" in any array of isolates.

32 Extrapolation Earlier to "a"

The experience of designing depth schedules for various subjects shows that, at least at a future date, some schedule or other may require extrapolation earlier to "a". Here we can consider three approaches, namely:

1 Use of new set of species of digits -- such as, the alphabets of a natural language;

2 Use of a single new sectorising digit;

3 Manipulation of existing digits of the notational system of CC.

These methods have already been discussed in connection with extrapolation in the schedule of (MS).

321 Use of a Set of New Species of Digits

For reasons similar to those mentioned in Sec 23, the use of a set of new species of digits such as, the letters of Greek, Cyrillic, or Sanskrit alphabet -- is ruled out.

322 Use of a Sectorising Digit

The procedure suggested in Sec 24 is applicable in the case of array isolates also. Thus, using " ↑ " (upward arrow) or an " * " (asterisk) as a sectorising digit of ordinal value less than "a", we can have 15 sectors of 265 coordinate digit-combinations in all, with no digit-combi-

nation having more than 3 digits, for extrapolation earlier to "a". The details are given in the table in Sec 24.

323 Manipulation of Existing Digits

For obvious reasons, the kind of manipulation of the existing digits mentioned in Sec 25 is not practicable in the case of (IN). But the use of an Anteriorising digit is possible.

324 Use of Anteriorising Digit

In this method, a digit with Anteriorising quality and postulated to be Empty-Emptying is suffixed to "a". The notational system of CC has two semantically empty digits with Anteriorising quality. But neither has the emptying capacity. If, for example, we postulate that "↑" (upward arrow) or the " * " (asterisk) to be such a digit with the lowest ordinal value among the Anteriorising digits, then we can have coordinate digit-combinations, such as the following for extrapolation earlier to "a".

SN	Sector	Numbers	N of (IN)
1	(S-a*a)	a* a, a* b, ... a* y	22
2	(S-a*1)	a* 1, a* 2, ... a* 8	8
3	(S-a*A)	a* A, a* B, ... a* Y	23
		Total ..	53

483

Thus, under the condition that no (IN) shall have more than 3 digits, we get 3 sectors giving a total of 53 (IN) for extrapolation earlier to "a". This is comparatively a smaller number of (IN) than what can be got by the use of a sectorising digit, as suggested in Sec 322. Further, in the procedure described in this section, each of the digit-combinations will have 3 digits. By the other method, we can get 53 (IN) each with only two digits.

4 DIGIT TO INDICATE PARTIAL COMPREHENSION

41 Problem of Using Subject Device

The digit "Z" is used to denote Partial Comprehension of Basic Subjects as well as of (IN). It is also used as an Empty digit. Consider the following (IN):

2	3A	3Z	6
3	3B	4	7
31	3X	41	8
32	3Y	5	9a

Here, let the (IN) 3Z represent a Partial Comprehension of the immediately succeeding (IN) 4, 5, and 6 and their respective subdivisions. Now, if it becomes necessary to sharpen the (IN) 3 using the Subject Device, we will then have (IN) such as the following:

3(B)	3(G)
3(D)	3(G;4)

These will get interpolated as follows:

2	3A	3Z	3(G;4)	6
3	3B	3(B)	4	7
31	3X	3(D)	41	8
32	3Y	3(G)	5	9a

This is obviously an unhelpful arrangement. It does not implement the findings of the idea plane. Further, as shown in Sec 51 below, an (IN) such as "3Z" may be a devised (IN) using the Alphabetical Device.

42 Use of Digit of Highest Ordinal Value

A solution to the above problem will be to use for Partial Comprehension a digit of ordinal value higher than that of "(" (starter). For example, if "↓" (downward arrow) is used as such a digit, the sequence will now be helpful:

2	3A	3(B)	3↓	67
3	3B	3(D)	4	7
31	3X	3(G)	41	8
32	3Y	3(G;4)	5	9a

43 Use of Digit with Anteriorising Capacity

Another method for accommodating Partial Comprehension is to use -- that is, suffix -- an Anteriorising digit of the lowest ordinal value among the Anteriorising digits in the system to the substantive digit representing the first Basic Subject or (IN), as the case may be, comprehended by the Partial Comprehension concerned. In the

present notational system of CC, "←" (backward arrow) is such a digit (28). If one of the suggestions in Sec 324 is accepted, then either "↑" (upward arrow) or "*" (asterisk), as the case may be, will replace " ←" (backward arrow). The sequence of the (IN) will also now be helpful.

2	3A	3(B)	4*Z	6
3	3B	3(D)	4	7
31	3X	3(G)	41	8
32	3Y	3(G;4)	5	9a

431 Preferred Digit

Although "←" (backward arrow) is a distinctive digit, it is not generally available on the typewriter. Use of the virgule (/) or asterisk (*) is preferred It can be postulated to have anteriorising quality and the lowest ordinal value among the Anteriorising digits, the other digits being "←" and " " ". The virgule and the asterisk are generally available in all typewriters as a single stroke. Either is not likely to be confused with any other digit in the notational system of CC.

44 Digit to Indicate Quasi Isolate

The provision made for representing Partial Comprehension can be conveniently used to represent quasi-isolates.

5 DISTINCTIVE INDICATOR DIGIT FOR DEVICE

51 Enumerative vs Devised (IN)

In addition to enumeration, CC uses several

devices for the formation and sharpening of (IN) -- for example -- Chronological Device, Environment Device, Numerical Device, and Subject Device.

1 Consider the following (IN): 3N

Its structure indicates that it can be either an enumerated one or a devised one. The possible devices are Chronological Device and Alphabetical Device.

2 Consider the following (IN): 9M and 9M42.

Each of the (IN) can be either an enumerated one or a devised one. The possible devices in the first (IN) are Chronological Device, Environment Device, and Alphabetical Device. The possible devices in the second (IN) are Chronological Device, Environment Device, and very rarely Alphabetical Device.

3 Consider the following (IN): S(B) and (B).

Each of the (IN) can be either an enumerated one -- that is, using the sector (S-(A)) -- or a devised one. The possible devices are Subject Device and Alphabetical Device.

52 Expressiveness of Class Number and Increase in Capacity of Array

In actual practice, there is usually no conflict of the kind mentioned above. Because two or more methods of formation of the same array is not prescribed in CC. However, the

notation would be truly expressive if the structure of the (IN) indicates its mode of formation including which device has been used in the case of a devised (IN), without having to refer to the schedules or to the rules. Further, the capacity of the array can be increased if a distinctive digit is used for each of the devices. For the purpose of illustration, let us use "+" (plus) to introduce the Alphabetical Device and no indicator digit for enumeration. Then we can have (IN), such as the following:

3+B	3B	3P
3+BE	3BE	3R
3+K	3K	3R1
3+N	3N	3RB

There is no conflict between the two sets of (IN); the notation is expressive; and the capacity of the array is increased, in fact, doubled.

52Z Different Varieties of Manifestation of "Matter"

The manifestation of "Matter" is now deemed to be of three varieties, namely, Matter (Material), Matter (Property), and Matter (Method). One and the same indicator digit ";" (semicolon) is used for each of the three varieties. The occurrence of homonym in (CN) is avoided by allocating different sectors to each of the three varieties of Matter wherever necessary. However,

this reduces the number of sectors available for allocation to each of the three schedules.

53 Factors for Consideration

In considering the use of different indicator digits for the different manifestations of "Matter", the following factors are to be considered:

1 The sequence in which the subjects are to be arranged if an (IN) from each of the three schedules for "Matter" is added to the same host subject; and

2 Will it be helpful to retain the ";" (semicolon) to indicate the "primary" manifestation "Matter" with a suffix to it for the three varieties of "Matter" manifestation, or have a distinctively different digit for each of the varieties of "Matter" manifestation.

54 Factor 1

It is quite difficult to find examples of subjects in which an (IN) from each of the three schedules for "Matter" manifestation may be added to one and the same host subject. However, even if this should occur, the preferred sequence will be

Host subject; Matter (Method)
Host subject; Matter (Property)
Host subject; Matter (Material)

The Principle of Increasing Concreteness is used in deriving the sequence. This gives an idea of

the ordinal value to be assigned to each of the indicator digits for the three manifestations of "Matter".

It may become necessary to use successively two or more ideas from one and the same schedule, say, that of Matter (Property). The two ideas may occur as distinctive levels or one may be a speciator for the other. The sequence between the two components in either context is determined by the Wall-Picture Principle (29). Here are two examples:

11 Medicine (BS), Arm; Disease (1MP1); Malignancy (1MP2)

12 Medicine (BS), Arm; Disease-Malignant (1MP1)

21 Microbiology (BS), Microorganism (1P1); Virulence (1MP1)

22 Microbiology (BS), Microorganism-Virulent (1P1)

In some of the depth schedules, provision has been made to use an (IN) as a speciator, wherever necessary, to another (IN) in the same schedule.

55 Factor 2

Since "Method", "Property" and "Material" is each deemed to be a manifestation of "Matter" it will add to the expressiveness of the notation if the ";" (semicolon) now used as Matter facet indicator is retained in each of the three manifestations of Matter, and another digit is suffixed to it for differentiation and securing

the sequence of subjects as mentioned in Sec 54. The disadvantage is that it may increase the number of digits in each of the (IN) for the different varieties of manifestation of Matter.

56 New Indicator Digits

It is inadvisable to use any of the substantive digits as suffix to ";". It will lead to homonym. In introducing a new digit, the conditions mentioned in Sec 23 have to be borne in mind. A punctuation mark that is fairly widely used but not yet taken into the notational system of CC, is the " ⌈ " " ⌋ "(square bracket). We can use each of the parts -- the starter and the arrester -- as separate digits.

It is suggested that

1 Matter (Method) be indicated by ";⌋" (semi-colon and arrester square bracket) only:

2 Matter (Property) be indicated by the digit ";" (semi-colon); and

3 Matter (Material) be indicated by the digit combination "; ⌈" (semi-colon and starter square bracket).

It is further suggested that the indicator digits for Matter (Method), Matter (Property) and Matter (Material) fall in the following sequence when arranged in the increasing sequence of their ordinal value: ";⌋" ";" ";⌈". In subjects, ideas denoting Property are found to occur more frequently than ideas denoting either Method or Material. Hence a single indicator digit is

prescribed for Matter (Property). This proposition would facilitate the use of all the sectors of the notational system of CC for each of the schedules of "Matter". It is also found that typewriters for typing scientific matter, commercial statistics, etc provide for square brackets. Even typewriters used in libraries are often provided with it.

57 Manifestations of "Matter": Idea Plane

On a consideration of the kind of ideas that denote "Property" and "Method" and on the basis of the practice followed by thesauri, an isolate denoting a "Property" or a "Method" is deemed to be a manifestation of "Matter". This helps to conform to the Postulate of Five Fundamental Categories.

571 Idea Denoting "Method"

The following experiences with ideas denoting Method are worth noting:

1 In general, a Method isolate is immediately preceded by an Energy isolate (4).

2 There are a few instances where a Method isolate is not preceded by an Energy isolate, but by a Property isolate. An example is a "Method of solution" in subjects going with the different Basic Subjects in Mathematics. However, it is to be noted that a "solution" to a "problem" is deemed a Property of the problem. In that case, a particular solution will be a "variety of solution".

492

Therefore, a particular solution is to be represented either as an array division or as a speciator to "solution".

3 When an idea denoting "Method" immediately follows an Energy isolate, it is more helpful to deem the former as a manifestation of Personality than of Matter. A suggestion has also been made that an idea denoting "Method" be deemed as a speciator to the Energy isolate to which it is attached. Depth schedules built on this basis have not been found unhelpful (35,36) The suggestion deserves further investigation.

4 When an idea denoting a "Method" is the primary focus of study in a subject, it becomes an isolate in (1P1) in that subject.

Thus, an idea denoting a "Method" may occur as

1 (1P1) isolate; or

2 Array division or speciator to "Property"; or

3 Personality isolate immediately preceded by an Energy isolate.

Therefore, the question of deeming a idea denoting a "Method" as a manifestation of "Matter" does not seem to arise.

572 Idea Denoting "Property"

The following experiences with ideas denoting "Property" are worth noting:

1 A Property isolate is always preceded by some other isolate -- such as, Personality isolate, or

Matter (Material) isolate, Matter (Property) isolate, or Energy isolate (4);

2 If an idea denoting a Property is the primary focus of study in subjects going with a particular Basic Subject, then it is usually taken as an isolate in (1P1) in that subject;

3 It cannot be prescribed as a rule that the Property isolate should always follow the Matter (Material) isolate as a level when the two kinds of Matter isolates occur consecutively in a subject.

31 Several examples have been given in an earlier paper (18) to illustrate the violation of the Postulate of Level Cluster when the Wall-Picture Principle required the sequence Matter (Property) followed by Matter (Material).

32 In view of the violations of the Postulate of Level Cluster for Isolates, it was questioned whether an idea denoting a "Property" should be deemed an isolate at all (14). This is apart from an idea denoting a "Property" occurring as a speciator in a Compound Isolate.

33 It was suggested that an idea denoting a "Property" be deemed as another variety of idea -- just as we have Basic Subject idea, Isolate idea, Speciator idea, and Special component idea -- to be attached wherever appropriate and helpful and as determined by the Principles for Helpful Sequence (15).

The above discussion largely concerns the idea plane. But any decision about the points

raised will have its repercussion in the notational plane. For example, the use of ";" (semi-colon) in association with another indicator digit for Matter (Method) and Matter (Material), as suggested in Sec 56, will be affected. Such combinations may not be necessary.

6 COMMON SCHEDULE

Most schemes for library classification provide for "Divide like" device. It secures economy in schedule building and conformity to the Canons of Helpful Sequence, Consistence Sequence, and Scheduled Mnemonics. In designing depth schedules for a subject, it has been found that a whole schedule of ideas or a good portion of it can occur as:

1 Isolates in two or more Rounds;

2 Speciators to isolates in two or more Rounds; and

3 Component of array isolates.

This is in conformity with the idea of a freely-faceted classification.

This was particularly recognised in designing depth schedules for "Food technology" (22) and "Air vehicle wing production" (20). Eight common schedule of ideas was provided for in the latter case. A number from any one of these schedules could be used in any of the ways mentioned above. A similar provision was made in the depth schedules for "Banking" (2) and "Investment" (6). The preparation of such common schedules for use in the

classification of different subjects, in the different ways mentioned above could be explored further.

7 MNEMONICS

71 Letters of the Roman Alphabet

With a view to conforming to the Canons of Mnemonics to a fuller extent, each of the capital letters of the Roman Alphabet were equated with a Hindu-Arabic numeral while designing the depth schedule for "Motor vehicle production" (19). When the lower case letters of the Roman alphabet were deprived of their anteriorising quality and made available for division of array, each of them was also equated with a Hindu-Arabic numeral so as to facilitate their mnemonic use (21). In the design of depth schedules done during the last two years, such use of the letters of the Roman alphabet has been demonstrated.

72 Seminal Mnemonics

A possible rationale implied in the association of a specific set of ideas with each of the Hindu-Arabic numerals has been discussed, using the concept of system analysis (8). The extension of such an analysis to other sets of ideas associated with the numerals as postulated in CC, may yield useful results. It has been a long standing suggestion that an investigation whether the letters of the Roman alphabet have their own seminal mnemonics, just as the Hindu-Arabic numerals have, should be carried out.

8 ALLOCATION OF SECTORS

In 1966, a few empirical principles were formulated to aid the allocation of sectors to the schedules in (1P1) (12). On the basis of further experience in arranging the isolates and speciators in a helpful sequence, a pattern for the allocation of sectors in (1P1) in a scheme for the classification of subjects going with a host subject in Commodity Production Engineering, and Commodity Production Technology has been suggested (17). It should be examined whether this pattern of allocation of sectors can be used in the design of depth schedules for other subjects. If it is not helpful, other more helpful patterns should be evolved.

91 CONCLUSION

911 Development Since 1969

In CC, ed 1 (1933), only two indicator digits -- namely, ":" (colon) and "0" (zero) -- were used. When attention was turned on to the design of depth schedules for documentation purposes about 1950, the number of indicator digits had to be increased. Nearly four decades after its first formulation, CC has found it necessary to use about a dozen indicator digits to meet the needs of classification of an ever-developing universe of subjects. The developments in the notational system of CC have been reviewed in a recent paper (26). The following table gives an idea of the further developments since 1969:

SN	Indicator Digit	Purpose	Proposed in	Used in	
				Year	CC
1	= (Equal to sign)	For connecting a Special Component Earlier (1965-70) used for connecting the abbreviations of the component words of a multinomial term to which the Alphabetical Device is applied	1970 (16)	1971	Ed 7
2	" (Double inverted comma)	For use as an anteriorising digit and depriving the Roman smalls of their anteriorising value	1968 (11)	1969	Ed 7
3	+ (plus)	For connecting abbreviations of component words of a multinomial term to which the Alphabetical Device is applied Earlier "=" (Equal to sign) was used for this purpose	1971 (30)	1971	Ed 7

The developments in the universe of subjects in the future on the one hand, and the need to have expressive coextensive (CN) for each subject on the other, are likely to force on the classificationist the use of even more number of indicator digits, sectorising digits, etc. This paper attempted to indicate a few trends.

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500

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C O N T E N T S

AREA 4 : DRTC RESEARCH CELL REPORT FOR 1971

Paper	Author and Title	Page
DA	GOPINATH (M A). Classification research.	505-18
DB	BHATTACHARYYA (G). Cataloguing research.	519-27
DC	GOPINATH (M A). Studies in documentation.	528-33
DD	RANGANATHAN (S R). Ten years of work: A review and a preview.	534-56

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0 INTRODUCTION

This is a technical report of the classification research done by or guided by, the members of the DRTC Research Cell, in 1971. Work on the following subjects is highlighted:

1 Difference between schemes for knowledge classification and schemes for library classification. (Sec 1);

2 Development of theory for library classification with particular reference to UDC (Sec 2);

3 The Biological and linguistic basis for syntax of facets of subjects (Sec 3);

4 Depth versions of CC (Sec 4);

5 Comparative study of schemes for library classification (Sec 5);

6 Future of CC (Sec 6); and

7 Developing the versatility of the notational system of CC (Sec 7).

1 DIFFERENCE BETWEEN KNOWLEDGE CLASSIFICATION AND LIBRARY CLASSIFICATION

The essential difference between a scheme for

library classification and a scheme for knowledge classification was examined by S R Ranganathan and G Bhattacharyya in a paper presented to the International Conference on the Conceptual Basis of Classification of Knowledge, held in Ottawa, from 1 to 5 October 1971 (19). The essential purpose of a scheme for library classification is to arrange the subjects embodied in documents or their main entries in a classified catalogue in a sequence helpful to a majority of readers. Further, in order to mechanise the arrangement, each of the different subjects in the universe of subjects embodied in the documents is to be fitted with a class number. For classifying the subjects, the scheme for library classification is to be fitted with a notational system. On the other hand, a scheme for knowledge classification is largely a product of intellectual curiosity of a philosopher. It is largely spec speculative and theoretical. It may not have a purpose -- such as, the arrangement of knowledge embodied in documents in a helpful sequence -- in view. It is largely a search for the rationale of the structure and growth of knowledge. However, schemes for knowledge classification are useful in the design of schemes for library classification. There is ample evidence of the impact of the schemes for knowledge classification on the design of schemes for library classification. The latter, however, have to be detailed and specific as their pur-

pose is to arrange documents or their entries.

2 THEORY OF LIBRARY CLASSIFICATION AND THE UDC

21 Development of a Theory

In a paper presented at the International Symposium on "UDC in relation to other indexing languages", held at Herceg Novi (Yugoslavia) from 28 June to 1 July 1971, Neelameghan (11) pointed out the ubiquitous role of classification in the design, development, and use of document finding systems. In order to develop an efficient scheme for library classification, it should be based on a sound theory of library classification. The attributes of the development of the universe of subjects and the psychology of readers affect the design, development, and use of a universal scheme for classification. It must have the capacity and resilience to receive each new idea and subject as and when they arise, accommodate them in the appropriate place in the universe of subjects preferred by the majority of specialist readers, and enable a unique and coextensive structuring of each subject using a classificatory language of ordinal numbers. Such a self-perpetuating scheme for library classification should be based on and be able to keep step with, the developments in the general theory of classification constituted out of the necessary hierarchy of guiding principles. The general theory should itself be continually refined on the basis of the findings of research on the attributes of the universe of

subjects, psychology of readers, and performance of the scheme in practice. Such a general theory of classification is now available. The Colon Classification demonstrates in-practice, the helpfulness of using such a theory. UDC too can make use of this theory with advantage and refine it whenever necessary. This appears to be the productive way of developing UDC into a universal classification system.

In a postscript (9) to the Herceg-Novi Symposium on UDC, Neelameghan analysed the various contributions to the Symposium. He has highlighted the advantage of using the theory of library classification developed in India.

3 BASIS FOR FACET SYNTAX

In 1966, Ranganathan formulated the Postulate of Absolute Syntax -- that is, the sequence in which the component ideas of compound subjects going with a Basic Subject usually arrange themselves in the minds of the majority of normal intellectuals (18). He also suggested that the syntax of facets should parallel the absolute syntax. Neelameghan (6) has illustrated the value of such a postulate in the development of a self-perpetuating, fairly stable, consistent, and versatile scheme

for classification of the universe of subjects. Research in biology and in linguistics on the syntax of ideas supports the Postulate of Absolute Syntax. The possibility of inter-conversion of the name of subject expressed in one natural language into another via the Class Number, based on the General Theory of Library Classification, using a computer, is also pointed out.

31 Aids to Classification System

In a paper contributed to the International Conference on Information Science (Tel Aviv) (1971), Neelameghan and Gopinath (15) highlight the advantage of recognising the uniqueness of facet structure of each subject arrived at on the basis of postulates and principles for facet sequence. Thus, in the classificatory language, each subject will get a unique class number. The resulting classified arrangement satisfies a majority among readers. As a complementary to this, a simple bipartite classified catalogue provides the reader facility of selection of documents on his particular subject-at-the moment, irrespective of the name of the component idea in the subject he may bring up in using the system.

4 SCHEDULES CONSTRUCTED

41 Colon Classification, ed 7

Work on Colon Classification, ed 7, has been continued. The schedules for subjects

going with the Main Subject "E Chemistry" and "F Technology" were revised during 1971.

42 Design of Depth Schedules

During 1971, fourteen depth version of Colon Classification have been worked out. The subjects of these are listed in the following table.

SN	CC Number	Subject	Author	Ref
1	D8,A31	Lathe production	M A Gopinath	3
2	D8,D4h	Steam generator production	A Neelameghan and M A Gopinath	14
3	F8,c62	Semiconductor technology	A B Marigowda	*
4	G;6	Genetics	Sayeeda	*
5	H2	Petrology	M Parameswaran	*
6	HX	Mining	K M Sinha	*
7	I;4	Human diseases	S Seetharama	21
8	PX	Programming language	I K Ravichandra Rao and Kanti Rawat	*
9	X62	Banking	A Neelameghan	5
10	X65	Investment	A Neelameghan	8
11	X72	Taxation	A Neelameghan	10
12	X95	International trade	A Neelameghan	7
13	XT	Econometrics	N Sambamurthy	*
14	Y	Sociology	B P Mukherjee	*

The itmes marked by asterisk (*) are designed by the DRTC trainees (1969-70) and research scholars (1970). They are not yet published.

510

5 COMPARATIVE STUDY OF THE SCHEMES FOR LIBRARY CLASSIFICATION

During 1971, comparative studies of the current versions of the Colon Classification and the Universal Decimal Classification have been done. The results of these studies have been presented in the papers for this Seminar. Each of these papers demonstrates a methodology for the comparative study of schemes.

51 Normative Principles as the Basis for Comparison

Bhattacharyya (1) has compared the principles governing the design and development of UDC with those governing the design and development of CC. The principles governing the design and development of CC are explicitly stated, whereas the principles governing the design and development of UDC are implied. These implied principles are distilled out from the General Introduction, Outline Structure, Auxiliary Tables, from the schedules and from the Guide to UDC. It is shown that there is similarity in the principles governing both the schemes for classification. But, in practice, the UDC has some amount of rigidity due to its enumerative DC core. However, UDC has prescribed several devices to minimise this rigidity, though at the cost of overall economy and efficiency. Thus, a rethinking on the design and development of UDC is necessary.

511

52 Complex Subjects in CC and UDC

Jayarajan and Gopinath (4) have studied the provisions made in CC and UDC for classifying complex subjects. CC has provided distinctive indicator digits to coextensively indicate in each of the different class numbers, varieties of phase relation that may occur between the two phases in a complex subject. UDC, on the other hand, has not provided distinctive indicator digits for phase relation, although the " : " (colon) may be used for the construction of the class number for a complex subject. This leads to homonyms in class numbers, which ultimately leads to unhelpful sequence of subjects. The paper also discusses the pros and cons of recognising "Intra-Chain Phase Relation".

53 Recognition and Accommodation of New Main Subjects

Neelameghan and Gopinath (13) have studied the hospitality of CC and UDC systems in accommodating new Main Subjects. The study is largely confined to Fused Main Subjects. The concepts of Fusion and Fused Main Subjects are helpful in the design and development of a scheme for classification fit to meet the developments in the universe of subjects on the one hand and psychology of readers, on the other. CC has accommodated many new Fused Main Subjects as Adjunct Main Subjects to one or the other of

the existing Main Subjects. This was possible because of the versatility of the notational system of CC being enriched by the postulates of Emptying and Empty-Emptying Digits. On the other hand, UDC has not made adequate provision to accommodate new Main Subjects. Further, it has not been able to indicate coextensively the different strengths of bond between any two components of the subjects. This leads to homonym in class numbers as illustrated in Sec 762 of Paper CD. In some other cases, the new Main Subjects are represented as compound subjects. "577.1 Biochemistry" is an example.

54 Comparison of Facet Sequence of Subjects Going with the Host Subject "Aerodynamics"

T Ranganathan and Neelameghan (20) have studied the facet-structure for twenty selected subjects in "Aerodynamics of aircraft wing" as represented by CC numbers and UDC numbers. Each subject was classified by a depth version of CC and the result compared with the UDC number given on the catalogue cards, supplied with each technical report. It was found that an UDC number, constructed in conformity with the postulates and principles of the General Theory of Library Classification, represents more coextensively the subjects under consideration. This demonstrates the helpfulness of basing the design of UDC on a general theory of library classification.

55 Comparison of Schedules on "Geology"

Parameswaran (16) has made a comparative study of the schedules for subjects going with the main subject "Geology" in CC and UDC. The basis of reference in this comparison is the set of canons, principles, and postulates formulated by Ranganathan. The study points out that the hierarchical structure of subjects going with Geology are represented more co-extensively in CC than in UDC. Arrangement of compound subjects in both the schemes conforms to the principles for helpful sequence. In UDC, any deviation from the postulates and principles in respect of the sequence of facets and in compound subjects in UDC number is due to its enumerative DC core.

56. Comparison of Class Numbers for "Human Disease" in CC and UDC

Seetharama and Gopinath (21) have made a comparative study of the CC and UDC class numbers for subjects going with the host subject "Medicine, Disease". The study centres round the CC and UDC class numbers for an assortment of 100 books selected from the Annual Volume of the British national bibliography (1969). The criteria chosen for comparison are

1 Coextensiveness;

2 Brevity in notation;

3 Similarity of pattern in the sequence of components of all compound subjects; and

4 Similarity in the pattern of sequence of facets of all compound subjects; and

5 Helpfulness of the overall sequence of the compound subjects.

The deficiencies of UDC numbers can be made good if it is made to conform to a sound theory of library classification.

6 FUTURE OF COLON CLASSIFICATION

In a paper on Colon Classification, presented to the symposium on "Prospects for classification", Gopinath (2) emphasises that CC is a freely-faceted classification based on a sound theory of library classification. Therefore, it is possible to revise the schedules for subjects going with a particular basic subject in the light of new developments in those subjects with least disturbance to the structure of the classification as a whole. In particular, any reassignment of isolates will involve change only within a short range of the sequence of subjects. Generally, it will not involve tidal changes such as shifting a Main Subject, or transferring a component subject from one Main Subject to another. CC will be able to keep step with the changes in the universe of subjects, and its expectation of productive life will be far greater than that for any other scheme for library classification in vogue at present.

7 INCREASING THE VERSATILITY OF CC NOTATIONAL SYSTEM

In a paper presented to this Seminar (12), Neelameghan has pointed out that two schemes for library classification can be compared on the capa-

city of the respective notational systems in implementing the findings of the idea plane. Therefore, in order to keep a scheme for library classification resilient enough to meet new situations, the versatility of a notational system should be continuously increased. In other words, the notational system of a scheme for classification should be endowed with self-perpetuating quality guided by a set of canons, principles, and postulates. Neelameghan has explored the potentialities of the CC notational system in meeting the new developments in the universe of subjects.

8 AREA FOR RESEARCH IN CLASSIFICATION

In a paper presented to this Seminar, Ranganathan (16) has pointed out that the dominant area for research in library classification is the notational plane.

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CATALOGUING RESEARCH.

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0 INTRODUCTION

This is a technical report of the research in cataloguing done by the members of the DRTC Research Cell in 1971. The following are the specific areas in which research has been carried out:

1 Standardisation of title-leaf information;

2 Symbiosis between the main entry and the abstract;

3 Resolution of the conflict of authorship when the name of the original author is merged in the title;

4 Entry element in the name of an institution; and

5 Relative Index and Chain Procedure.

1 STANDARDISATION OF TITLE-LEAF INFORMATION

Standardisation and simplification have become a necessity today, in order to release the creative impulse of man. Cataloguing rules for the books of the past bristle with difficulties, as the title-leaf of such a book did not conform to any standard.

But in collaboration with the publishing and printing trades, the library profession can bring about a standard for the title-page and its back. This standard will make the title-leaf give all the necessary catal oguing information for the books of future. This will lead to a simplification of cataloguing rules and to an accepted standard for the main entry of a book of the future. Based on the idea mentioned above, S R Ranganathan has suggested standards for the following:

1 Personal author statement;
2 Corporate author statement;
3 Collaborator statement;
4 Supplement to author statement; and
5 Supplement to collaborator statement.

All these statements are to be printed on the back of the title-page. For, the title-page itself should be largely left to the freedom of the artist designing it, except for his being asked to mention on it, the title of the book, and the name of the author. The consequential simplification of the cataloguing rules also has been indicated. The formulation of the simplified prescriptions is to be governed by the need of a "Service Library" whose books are virtually replaced at lease once within a generation. It should not be governed by the need of a "Dormitary Library" preserving each book for the occasional use of bibliophiles and antiquarians and as cultural deposit (4).

2 SYMBIOSIS BETWEEN THE MAIN ENTRY AND THE ABSTRACT

The present rules of the Classified catalogue code do not provide for subject heading in the main entry. They provide only for call number being put in the leading section. The users of the main entry will be better helped if the subject heading of the document is added as Section 2 in the main entry, than as they are at present without this help. To implement the idea mentioned above, S R Ranganathan and S Seetharama have suggested amendments to the rules of the Classifiec catalogue code (for the main entry in an abstracting periodical (documentation list) so as to insert in Section 2 of the main entry the translation of the class number in facet terms. This translation is meant to serve as the subject heading. They have suggested restriction of the feature heading to class numbers with not more than three facets. The changes in the rules have been illustrated with 18 examples. The possibility of slimming the abstract by omitting the indicative part in it, has also been illustrated with examples. The authors have requested the documentalists to examine the result of this proposal on the helpfulness to and tempo of specialist readers when compared with the same, if each class number is used for providing with a feature heading, irrespective of the number of facets. (5).

3 RESOLUTION OF CONFLICT OF AUTHORSHIP

If the name of the original author is merged in the title, it may give rise to a conflict of

authorship. Ordinarily, such a conflict falls in the category "Person vs Person". As regards the resolution of a conflict of authorship, the implication of the Principle of Unity of Idea is that a cataloguing code should

1 Recognise the resolution of a conflict of authorship as a problem quite distinct from those of choice, rendering, and recording the name of the author; and

2 Give an independent set of rules for the resolution of conflict of authorship.

A conflict of authorship arising out of the merger of the name of the original author in the title, should ordinarily be resolved at the level of definition of terms -- that is with reference to the formal definitions of the terms 'Personal Author' and 'Personal Collaborator'. If they do not prove sufficient for the purpose, the definition of the term 'Personal Author' is to be propped up by an interpretative definition. In the light of the criteria mentioned above, S R Ranganathan and G Bhattacharyya have made a comparative study of the respective approaches to resolve such a conflict, of the different editions of the Classified catalogue code with that of the different editions of the Anglo-American cataloguing rules. The following interpretative definition of the term 'Author' have been proposed by them to resolve such a conflict: "In case the name of the author of the original work is merged in the title of the revised work,

the author of the original work is the author of revised work if the reviser himself definitely indicates, in the Collaborator Statement on the title-leaf, that he himself is only a collaborator of the work concerned" (6).

4 ENTRY ELEMENT IN THE NAME OF AN INSTITUTION

41 Opinion Survey

The efficiency of a catalogue in responding to a query from a reader, is to be considered primarily in relation to the capacity of the reader's memory in recalling a name encountered by him at least once. Such a name may generally be the name of a person, or of a corporate body, or of a document (title), or of a series. In the case of a multiworded name of any one of such entities, the probability of its exact recall by a reader is considerably low. In these circumstances, the library catalogue should take the responsibility of serving as an externalised memory. In other words, it should be able to

1 Predict the appropriate "cue" for the name of an entity with which in mind, the reader may approach the catalogue; and

2 Display in the context of the cue chosen, the necessary and sufficient visual aids to help exact recall.

Such a cue has to be a word or word-group having the highest recall-value -- that is, the potency of being called back to memory by the majority of ... readers.

The above findings about the deep psychology of human memory, learning, and recall have led to the formulation of the Canon of Recall-Value. It is the principle that in the multi-worded name of an entity, the Entry Element is to consist of the word or word-group with the highest Recall-Value. Theoretically, this Canon should directly govern the formulation of the individual rules for rendering the heading of the main entry. The DRTC Mid-Year Seminar of Cataloguing (1970) was turned on this topic. Based on this Canon, objective rules for rendering the different kinds of multiworded names were formulated and discussed in detail in that Seminar. The Seminar felt that the decision about the use of this Canon in practice should be based on the results of an wide-scale opinion Survey of mature research workers. Being prompted by this consensus, S R Ranganathan conducted an Opnion Survey among about 1000 mature research workers, on the choice of the Entry Element in the name of an institution, used as the heading of the main entry. In this work, he was assisted by P Jayarajan. The results have been tabulated under four heads. Generally-speaking, the subject of purview of the institution appears to have been preferred by the majority of readers. This implies that the name of the subject of purview, mentioned in the name of an institution, has the highest Recall-Value. This finding is of use in applying the Canon of Recall-Value. The Survey has shown that in the majority of cases, the Canon of Recall-Value can be easily applied. However,

there are certain types of cases needing a further survey (3).

42 Entry Element in the Name of a University

In the Opinion Survey mentioned in Sec 41, in many cases the readers easily chose the word with the highest Recall-Value in the name of an institution. But in the case of the name of a University, they could not express a definite opinion. Unlike the names of other kinds of institutions, the names of universities pose special difficulties. To overcome these, in his Ed 5 of the Classified catalogue code, S R Ranganathan has given some temporary solution by prescribing generic name cross reference index entry, under the word 'University'. P Jayarajan has analysed the opinions relating to the names of universities; and he has come to the conclusion that the main entry itself can be made under the word 'University' as the Entry Element. This will reduce the range of search for the name of a university, in the alphabetical part of the catalogue, considerably. It is an additional advantage to render the word 'University' in the language of the library. The dominent word or word-group in the name of a university should be used as the individualising Element only, and not as the Secondary Element (2).

5 RELATIVE INDEX AND CHAIN PROCEDURE

The document finding system devised by Dewey took the form of a classified catalogue. Cutter's

system took the form of a dictionary catalogue. The efficiency of each system was largely dependent on the procedure of constructing subject-headings to be used in it. Cutter gave a set of explicitly stated rules for this purpose. Dewey wanted the Relative Index to the DC schedules to be used as the substitute for the subject index to be prepared at the local level. There is no explicit statement of the principles and of the procedure followed by Dewey in the construction of the subject headings for the schedule-entries. G Bhattacharyya has examined the Relative Index of Dewey to distil out the implied principles and the procedure followed by Dewey. His examination has shown that Dewey's Procedure conforms to Cutter's Procedure to a large extent. But Dewey's Procedure includes a novel feature of using distinctly the word or word-group having the "contextual function" in addition to the word or word-group having the "specification function". Chain Procedure of Ranganathan is essentially different from Dewey's Procedure. In this procedure, the expressive name of specific subject is represented in terms of its fundamental components. The sequence of these components is uniformly and uniquely determined in all cases, according to a set of postulates and principles. Each component idea is denoted by its standard term. The Chain having the "name-of-subject in standard terms" as the Last Link, is determined. The different kinds of links -- such as, Sought Link, Unsought Link, and False Link -- are distinguished. A subject heading corresponding

to each of the sought links is derived according to a set of rules formulated to suit the purpose in hand. Obviously, a class number for a compound subject also, may form the basis for applying Chain Procedure; but this is not an essential feature of Chain Procedure. Dewey's Procedure and Chain Procedure mark two distinct successive stages of development in the theory of subject heading (1).

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STUDIES IN DOCUMENTATION.

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0 INTRODUCTION

This is a technical report of the research in documentation and related subjects done or guided by, the members of the DRTC Research Cell, in 1971. Work on the following subjects is highlighted:

1 Use of information in research and industry (Sec 1);

2 Pattern of use of information by research workers (Sec 2 and 3);

3 Impact of information on the postgraduate research (Sec 4);

4 Obsolescence and utility factors of periodical publications (Sec 5);

5 Study of new varieties of documentation periodical (Sec 5);

6 Guiding principles and standards for reference books (Sec 7);

7 Need for an annual review periodical in library science (Sec 8); and

8 Work on computer-aided document finding system (Sec 91).

1 USE OF INFORMATION IN SCIENCE AND INDUSTRY

In a paper presented to the Seminar, Neelameghan (5) points out that several sociological, institutional, and human factors affect the dissemination, diffusion, and use of information in an organisation. Thirty case studies from published reports are presented, to illustrate the use of information by research workers, inventors, and innovators.

2 PATTERN OF USE OF DOCUMENTS BY SPECIALISTS

In a paper presented to this Seminar, Raghavendra Rao (8) has surveyed the ways in which specialists search for documents relevant to the subjects of their respective interests. The study confines itself to the methods used by the specialists in searching for documents for preparing a review article in a specific subject. The survey was done in a university-cum-research type institution using the methods of citation analysis, questionnaire, and personal interview. The study presents the comments and suggestions by specialists on the aids for dissemination of information.

3 PATTERN OF USE OF DOCUMENTS BY RADIO ENGINEERS

In a paper presented to this Seminar, Gundu Rao (1) uses the method of citation analysis to find out the pattern of use of documents by specialists in Radio Engineering. The analysis also provides information on some other characteristics of documents in the subject -- such as, scatter of the pertinent information in a variety of documents, seepage, and

usefulness. The author compares the findings of this study with the findings of his earlier work (2).

4 IMPACT OF INFORMATION ON RESEARCH

It is not very uncommon that a research worker finds it necessary to modify the subject of research or even the abandoning of the entire research project on the basis of the availability or non-availability of information even as the work proceeds. This is illustrated by the study reported by Raghavendra Rao (9) in this Seminar. Thirty-two persons engaged in post-graduate research leading to the doctoral degree in a research-cum-academic institution were interviewed for this purpose. Fourteen research workers have reported one kind of impact or other of the published documents on their research programme. A summary of the narration by each of the research workers is presented as case studies. Aid in the selection of a specific subject for research, clarification of ideas and guidance in work, support for the line of approach adopted, unintended duplication of a part or whole of the work and consequent change in the work, are the different kinds of use and impact of published documents.

5 OBSOLESCENCE AND UTILITY FACTORS

In a paper presented to this Seminar, I K Ravichandra Rao (10) has studied the pattern of documents cited in the articles in the periodical publications Proceedings, Institution of Radio Engineers, and the Journal of the American Chemical Society. The differences in the value of obsolescence and utility

factors for these two periodicals have been worked out.

6 NEW VARIETY OF DOCUMENTATION PERIODICAL

New varieties of indexing and abstracting periodicals are published to meet the demands of readers. It is helpful for the documentalist to keep himself aware of these. They also throw light on the research in the different techniques in library science. As a case study, Jayarajan (4) has evaluated the Bulletin of peace proposals, a new variety of abstracting periodical promoted by the International Peace Research Association (Groningen).

7 ROLE OF GUIDING PRINCIPLES AND STANDARDS

In a paper presented to the IASLIC Conference (9)(1971), Neelameghan and Gopinath (7) point out that S R Ranganathan's Laws of Library Science can be used as the normative principles of Book Science. Conforming to the directions of each of these Laws in the preparation and production of reference books will lead to efficiency and productivity in the use of books such as reference tools. Guiding principles and standards can be formulated for the different features of the reference book and for the different items of work involved in preparing it. The Indian Standards Institution has formulated several guiding principles or standards in this respect. The library profession should promote the use of these in order to achieve overall efficiency and productivity in reference service.

8 ANNUAL REVIEW OF LIBRARY SCIENCE

In another paper presented to the IASLIC Conferenœ (9)(1971), Neelameghan and Gopinath have emphasised the need for the preparation and publication of an annual review of research in library science in India. Such a periodical would help faster dissemination of the research work on library science done in India. It would also act as a feeder to international review periodicals in library science. An organisation for the regular publication of such an annual review periodical is also suggested.

91 COMPUTER-AIDED DOCUMENT FINDING SYSTEM

During 1971, the research in computer-aided document finding system has centred round the development of programs for the following items of work:

1 Arrangement of entries for documents in a documentation list according to the ordinal value of the class numbers consisting of alphabets, numerals, and punctuation marks etc with prescribed ordinal values (3).

2 Cumulative alphabetical indexes to periodical publications.

Two-way sorting technique has been used for this purpose. In this technique, the sorting is done character-wise. This technique is helpful for arranging words of variable length. Programs have been written in Autocoder language. Programs in the PLAN language are being written for alphabetical arrangement of word entries in the cumulative indexes.

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TEN YEARS OF WORK: A REVIEW AND A PREVIEW.

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[A rapid account is given of the factors -- such as social pressure and need for conservation of research potential -- leading to the emergence of Documentation. Then follows a short account of the genesis, the objectives, the organisation and of the achievements of the DRTC during the last ten years. There are ten statistical tables on the old and present students and on the research output by the staff and the alumni. The tables show very small educational wastage. The work of the staff is described and the need for work chastity is emphasised. The auxilliary advantages of work chastity and the testimony of Purohit Swami are mentioned. Wish is expressed for staff sharing equally the responsibility of the results of all research done in the 'Bee-hive' spirit. Some suggestions are given for additional activities to be taken up in the second decade.]

1 INTRODUCTION

11 Population Pressure and Industrial Research

The Documentation Research and Training Centre (DRTC), Bangalore, was a brain child of our think-ahead, the Founder of the Indian Statistical Institute and eminent physicist later turned into

an even more able statistician,and a planning exrert -- Prof P C Mahalanobis, FRS. Perhaps he was the first among us to have the statesmanly vision that the future development of India and her ever-increasing social well-being depended on intensive industrialisation. This view gets greatly emphasised by our mounting population figures and the national task brought in its train. This task is to help our country becoming much more self-contained than now, in respect of natural and agricultural resources and industrial resources. This can only be achieved by deep applied and industrial research in every field and also the necessary pure research to back it.

12 Conservation of Research Potential

In the discharge of this task, we have learnt something from the experience gained by the West, during the last 50 years. They realised -- and we also realise it now -- that an essential step is the conservation of research potential. To put it negatively, the wastage of the time and energy of research workers, searching through the pages of many learned periodicals, to find out the latest or the nascent new results got by other research workers, should be eliminated. Without any special organisation to eliminate this wastage, it had been estimated by regular survey work that 40 to 50% of the time of research workers was being wasted in the West in searching for irrelevant nascent documents A

similar survey has not yet been made in India. Probably the time is not yet ripe as India is warming up into a real mood of research and industrialisation, only of late.

13 The Organisation for Elimination of Wastage in Research Potential

Even about half a century ago, there was a vague sense of the need for an organisation for the elimination of wastage in research potential. The Special Libraries Association of USA (1908) and the Aslib of UK (1924) were two such early attempts. But the term 'Special Library' was not clearly meaningful for a long time. In fact, as late as 1949, the Editor of Special libraries (USA) asked me to write on this. The result was my paper, Special librarianship -- what it connotes, which appeared in pages 361-67 of Vol 40 (1949) of the periodical. My thesis was that the term 'Special Library' had been all along causing confusion; and that it was used as it were ineffable. But I said that this difficulty would be removed if we use the term 'Specialist Library' -- a library serving the needs of specialist readers. By the term 'Specialist Reader' is meant, a reader who specialises in a special subject -- usually a subject of narrow extension and great intension. Probably, this paper did give some clarification; for, when I went to USA in 1950, I was invited to attend a meeting of the New York Chapter of the Special Libraries Association and also the

Annual meeting of the Association in the Atlantic City. In both places, I felt that the members showed some appreciation of this definition, though the term 'Specialist Library' has not yet become current in the West; and the old ineffable term 'Special Library' still persists.

14 Iaslic of India

Largely an imitation of the Aslib of UK, as early as 1949, there was a proposal at the All India Library Conference at Nagpur that India too should form a Special Libraries Association. It was pointed out by me that

1 India had not developed specialist libraries;

2 There was hardly any specialist librarian -- at least sufficient in number to form an associatcn;

3 It was only the members of Indian Library Association that would have to be its members;

4 Such a duplication of membership would un necessarily lead to extra cost for each member: and

5 The Indian Library Association, which al ready had only a small membership, would be split into two associations. Further, I added that if any member had any ideas on Specialist Library problems, it was open to him to present them at a conference of the Indian Library Association or write papers on them for publication in the Organ of the Indian Library Association -- the Abgila about to be started. The

proposal was not then pressed. Actually, no paper was received on any specialist libraries problem either by the Abgila or by the Indian Library Conference till 1953, when my connection with these was severed and I left India. However, in 1955, while still in Zurich, I received an announcement that the Indian Library Association of Special Libraries and Information Centre (Iaslic) had been founded in Calcutta. I was also asked to accept an honorary membership of the same. I have every faith that Iaslic will turn its attention to the true corpus of the subject.

15 Documentation

The chief function of the organisation for eliminating the wastage of research potential is to save the time of the research worker in searching for the nascent documents in his specific subject of pursuit. Naturally, this work is germane to library work, though it has not been recognised and developed as such by the library profession. This recognition came slowly during the last 20 years. The library profession rose to the occasion. It recognised this work as of very high social importance. It also regarded it as a specialised branch of library service requiring the best ideas of the library profession. The term 'Documentalist' was introduced to emphasise the special nature of this work. Similarly, the term 'Documentation' was introduced to denote this work.

Documentation truly consists of:

1 Documentation work -- that is, scanning the current issues of learned periodicals and preparing a list of articles carrying nascent ideas. This is called Documentation List in anticipation;

2 Preparing Documentation list on demand in specific subjects; and

3 Documentation service -- that is, doing Reference Service with emphasis on specialist readers and nascent documents, also called Micro Documents.

These form the core of Documentation. They fall entirely within the competence and jurisdiction of the library profession. Documentation also includes certain fringe services such as

1 Procuring translation of documents from one language to another;

2 Procuring and supplying reprographs of articles on demand.

2 DRTC

21 Beginning

The conception of DRTC was developed in Zurich in 1956, when Prof P C Mahalanobis and myself met. He insisted on my coming back to India and develop our library system to serve the needs of research and industries, just beginning to develop. This problem was again

discussed in Calcutta in 1958. Ultimately, the details for establishing the DRTC were finalised in 1961. Prof Mahalanobis agreed

1 To provide the wherewithal for the DRTC;

2 The DRTC was to be established in Bangalore.

On my part, I agreed to

1 Lay down the lines along which the DRTC should be developed;

2 Organise the course of studies; and

3 Conduct the course for at least 3 years until it would take firm root

Sri Srinagabhushana of the Bangalore branch of the SQC kindly agreed to have charge of administration of DRTC. A Neelameghan was the first to join the teaching staff. He did so virtually of his own accord.

22 Objective

The objective of DRTC is to train documentalists and to conduct research in documentation. Emphasis on research and on advanced training in documentation work and service and doing research in the field. For this purpose, the number of students in restricted to 6. Some of these are deputed by industries or by research centres, some free-lance students are also admitted and paid a monthly stipend to meet their expenses.

23 Particulars about DRTC Students

The following tables present data about the DRTC alumni.

231 Number of Students

Number of Persons		
Admitted	Completed the Course and Examinations	Completed the Course only
59	56	3

Thus the educational wastage due to students who have completed the course, but not taken the final examinations has been 5 per cent. However, all the three persons are employed as librarians. The data in the succeeding tables relate to the 59 students.

232 Table 2: Sponsor-wise Distribution

SN	Sponsor	Number
1	Defence Research Laboratories	16
2	C S I R Laboratories ..	8
3	Other Research Centres ..	6
4	Universities and Colleges ..	12
5	Non-sponsored	17
	Total	59

233 Table 3. Employer-wise Distribution

SN	Employed in	Number
1	Defence Research Laboratories ..	7
2	C S I R Laboratories	8
3	Other Research Centres	13
4	Universities	9
5	Colleges	5
6	Industries	7
7	Teaching of Library Science ..	5
8	In Foreign country (USA) ..	4
9	Unemployed	1
		59

234 Table 4: Academic Degree-wise Distribution

SN	Degree	Number	SN	Degree	Number
1	M Sc	14	4	B Sc	28
2	M A	11	5	B A	5
3	M Com	1			
				Total	59

Nineteen out of 59 persons did not possess either a Diploma or a Degree in Library Science. They were all candidates deputed from various institutions. But they all had a minimum of two years' experience in libraries and in documentation centres. All the non-sponsored candidates possessed a post-graduate Degree or Diploma in Library Science.

542

235 Table 5: Grade-wise Distribution of the Employee Alumni

SN	Batch	N of students	Employed in Grade*						
			1	2	3	4	5	6	7
1	1962-63	7	1	2	4	-	-	-	-
2	1963-64	8	-	3	4	-	-	-	1
3	1964-65	8	1	-	5	2	-	-	-
4	1965-66	8	-	1	4	2	-	-	1
5	1966-67	7	-	1	3	1	-	-	2
6	1967-68	5	-	1	2	1	-	-	1
7	1968-69	5	-	1	2	2	-	-	-
8	1969-70	5	-	-	3	1	1	-	-
19	1970-71	6	-	-	4	1	-	1	-
	Total	59	2	9	31	10	1	1	5

*Grade 1 : Rs 1,100 and above
2 : Rs 700 to 1,250
3 : Rs 400 to 950
4 : Rs 325 to 625
5 : Rs 210 to 425
6 : Unemployed
7 : Abroad

236 Visiting Research Scholars

DRTC provides facility for research scholars and senior librarians to come and stay in its campus for short periods of two or three months or even longer, to work on specific projects. Since 1966, eight persons have taken advantage of this facility. The contributions of these persons are also included as contributions of DRTC alumni.

543

24 Method of Work

In DRTC, residence is compulsory. This is for making it possible for the students and the teachers to have all the waking hours available for their mutual consultation and discussion, apart from formal hours of meetings of all the students in the class-room or of select students for tutorial work. In addition, DRTC arranges weekly colloquia for

1 Talks by experts giving a bird's eye-view of some special subject or other;

2 Students themselves conducting a weekly colloquium for discussing specified topics in documentation, after due preparation for the same and conducting the discussion itself in conformity with the specified rules for such discussion. The DRTC also makes experiments in the methods of education for librarians in gene ral and documentalists in particular.

25 Annual Seminar

There are also two annual seminars attended by librarians and documentalists from all parts of India and occasionally by one or two foreigners;

1 Summer Seminar, in which a working paper is prepared by DRTC on a specified topic; and

2 Winter Seminar. This is conducted from 15 to 19 December. To this seminar, papers are contributed by the teachers, the students, and the

alumni of DRTC, other librarians, and documentalists in India and occasionally one or two foreigners.

The two Seminars continue on all the days from 9 am till late in the evening. To facilitate this, every attempt is made to supply lunch and light refreshments to the participants in the DRTC building itself. The papers and the proceedings of these Seminars are regularly published in a mimeographed form.

3 ACHIEVEMENTS

31 The Papers for This Seminar as an Index

The work of the DRTC till now has been given some satisfaction. We shall first examine the testimony implied in the contributions to the present seminar. The data for this are given below in Tables 1 and 2.

311 Table 6: Number of Contributors

Area and Subject	Number of Contributors				Total
	DRTC	Others from India		Foreign	
		DRTC Alumni	Others		
Area 1: Indexing, Abstracting and Reviewing periodicals	3	2	4	-	9

545

311 Table 6: Number of Contributors (Contd)

Area and Subject	Number of Contributors				Total
	DRTC	Others from India		Foreigner	
		DRTC Alumni	Others		
Area 2: Pattern of Use of Documents by Specialists	2	3	2	2	9
Area 3: Comparative Study of Schemes for Library Classification	6	2	-	-	8

312 Table 7: Numbers of Papers

SN	Subject	Number of Papers		
		DRTC Staff and Alumni	Others	
			India	Foreign
	Area 1: Abstracting, Indexing, and Reviewing Periodicals			
1	Abstracting ..	1	-	-
2	Abstracting periodical			
	21 Aerospace sciences	1	1	(Joint author)
	22 Nuclear physics	1	2	"
	23 Textile ..	-	1	
	24 Peace ..	1	-	

312 Table 7: Number of Papers (Contd)

SN	Subject	Number of Papers		
		DRTC Staff and Alumni	Others	
			India	Foreign
	Area 2: Pattern of Use of Documents by Specialists			
1	Pattern of Use			
	11 Generalia ..	-	2 (Jt auth)	1
	12 Science	3	-	
	13 Nuclear physics	1	-	
	14 Radio engineering	1	-	
	15 Aeronautics	-	1	
	16 Biology ..	-	1	
2	Obsolescence of periodicals ..	1	-	
	Area 3: Comparative Study of Schemes for Library Classification			
1	Classification	3	-	-
2	Comparison of CC and UDC			
	21 General ..	2	-	-
	22 Aerodynamics	1	-	-
	23 Geology ..	1	-	-
	24 Disease in Medicine	1	-	-
	Total	18	3	1

32 Data for the Period 1963 to 1971

321 Table 8: Contributors

Year	DRTC	Others		Total
		Foreign	India	
1963	3	6	17	26
1964	9	1	10	20
1965	9	1	6	16
1966	15	2	7	24
1967	22	1	3	26
1968	23	1	10	34
1969	18	3	12	33
1970	9	2	9	20
1971	14	2	6	22
Total	122	19	80	221

322 Table 9. Subject Covered by Contributions

SN	Subject	Year									Total
		'63	'64	'65	'66	'67	'68	'69	'70	'71	
1	Generalia	-	-	-	-	-	-	-	-	1	1
2	Univ of Sub	-	-	-	6	1	1	1	-	1	10
3	Classification	-	4	7	7	5	6	5	4	5	43
4	Cataloguing	-	2	2	-	4	-	2	7	-	17
5	Doc work	6	3	-	-	1	-	-	-	-	10
6	Doc service	-	-	-	4	3	-	-	15	-	22
7	Abstract	-	2	-	-	-	6	-	-	1	9
8	Reprography	-	-	-	-	3	-	-	-	-	3
9	Translation	-	-	-	-	-	-	4	-	-	4
10	Education in Doc	-	-	-	-	-	10	-	-	-	10
11	Librametry	-	-	-	-	-	-	14	-	-	14
12	Natural Science	2	3	-	-	-	-	-	-	3	8
13	Physics	1	-	-	-	-	1	-	-	-	2
14	Nuclear Physics	-	-	-	1	-	-	-	-	2	3
15	Building Eng	1	1	-	-	-	-	-	-	-	2
16	Electric Eng	3	-	-	-	-	-	-	-	1	4
17	Aeronautical Eng	-	-	-	-	-	-	-	-	3	3
18	Production Eng	-	5	7	3	2	-	-	-	-	17
19	Chemistry	2	-	-	-	-	-	-	-	-	2
20	Technology	1	-	1	-	2	2	-	-	-	6
21	Biology	1	-	-	-	-	-	-	-	1	2
22	Geology	-	-	-	-	-	-	-	-	1	1

Subject	Year '63	'64	'65	'66	'67	'68	'69	'70	'71	Total
23 Agriculture	1	1	1	1	-	-	-	-	-	4
24 Medicine	-	-	1	-	1	1	-	-	1	4
25 Public Health	-	-	-	-	-	-	1	-	-	1
26 Textile	-	-	-	-	-	-	-	-	1	1
27 Literature	-	-	-	-	-	1	-	-	-	1
28 Psychology	-	-	-	-	-	-	1	-	-	1
29 History	-	-	-	1	-	-	-	-	1	2
30 Economics	2	-	-	-	-	1	-	-	-	3
31 Social work	-	-	-	-	1	-	-	-	-	1
Total	20	21	19	23	23	28	20	26	22	211

The number of Seminar papers per year has been fluctuating between 20 and and 30.

33 Table 10: Research Output by DRTC

Contributor	Book	Tech Report	Research Paper	Depth Schedule	Total
Staff ..	8	5	438	26	477
Student	-	-	84	63	147
Total ..	8	5	522	89	624

It is noteworthy that about 25 per cent of the research output is from the alumni of DRTC.

4 STAFF OF DRTC

41 Head of DRTC

A Neelameghan voluntarily joined DRTC as Reader, in the very first year, 1962. He was appointed Professor in 1965 when the Government of India conferred on me the National Research Professorship in that year. It was also possible for me to hand over the headship of the DRTC to him in that year, after myself placing it on fairly good foundation and establishing standards of teaching and research work to the best of my ability.

42 Other Members of the Staff

It is to the credit of the DRTC that its own alumni came out at the top of all the candidates who had applied in response to open advertisements for its teaching and research posts. This has made the absorption of the staff with the spirit of the DRTC comparatively easy.

The teaching and research work is being carried on a high level.

5 WISH FOR STAFF LIFE IN DRTC

51 Total Absorption in Work

It is my earnest wish that the staff of the DRTC should continue in full measure the tradition and standard of work set by its two successive Heads. Its continuation is, by no means, easy.

To use my terminology, it requires "Absolute Work Chastity". The attention of each member of the staff should be totally turned on the Teaching and Research work of DRTC. No fraction of it should be given to any other interest, except what is needed for the family. Melvil Dewey, the first patriarch of our profession, has demonstrated the possibility of such work chastity. It has been said of him that "whether in the library or outside of it, his mind was completely absorbed in library matters. While walking, bathing, eating, or whatever else he was doing, his mind was always humming with library problems and solutions". Indeed to me he was a modern example in fulfilling the prescription of the Bhagavadgita about total abandonment to a cause.

52 Hours of Work

With the above mentioned Geeta standard in view, there can be no limited time schedule for the staff. Experience shows that nearly 12 hours of work at the work-spot itself and probably some carry-over of homework to be completed at home, are not unusual. Availability of the teachers to students will not be restricted to limited hours, except in the case of meeting the whole class for the daily lecture-cum-discussion. This may take about three hours in a day. During the remaining nine hours, the students have access to any teacher.

53 Example of the Staff

This high level of practice of work chastity

by the staff is itself an education to students. Some of the alumni -- even some of the outsiders attending the Annual Seminar run on whole-day basis -- have confessed to me that, deriving one's self-satisfaction and joy by this method was a revelation to them. Some of these have written about this that they had begun to practise it with great profit. I wish that they will continue to do so, and that more and more of the alumni do so as members of the staff of their own institutions.

6 AUXILIARY ADVANTAGES OF WORK CHASTITY

61 Deadening of the Sheath of Lower Emotions

Life in any situation, and particularly in an institution such as a service library or a documentation centre subordinate to a parent body, cannot be totally free from adverse happenings. That has been my experience in abundant measure. At this age of mine, I may say, without being charged of lack of humility, that I was able to withstand all such adverse happenings solely because of total absorption in work. It automatically led to a complete deadening of the sheath of lower emotions, that alone react to adverse happenings. All the time it was the intellectual sheath
and the sheath of higher emotions that were in active state. Pursuit of library science and library service gave unending opportunity for their ever being in an active state. It is so even today, at this age of mine. The joy arising out of this -- I can assure you and Neelameghan can assure you -- is second to none in the world. What else is the birth right of man?

552

62 Corruption by Money

Another factor usually impeding the practice of work chastity and the attainment of total joy thereby is the not-easily-exorable temptation of money. Any one who wants to enjoy work chastity and derive supreme joy by absorption in his work -- the work of the library profession is no exception to it -- should overcome the inexorability of the craving for money, for more money, and for ever increasing bank balance. Particularly the lure of small sums and materials in and beyond the margin of utility should be totally overcome.

63 Testimony of Purohit Swami

I may here disclose an experience of mine in regard to the value of work chastity in spite of many adverse happenings. By 1937, I had put in 20 years of service and had become eligible for pension. At that time I thought of escaping from emotional disturbances and what I imagined to be a possible danger of total absorption in intellectual work. I therefore decided to retire to get more congenial and lasting peace of mind. Just at this juncture, Purohit Swami, met me in my library. To cut the story short, he said, "Do not think that you can buy bottles of peace from Ramanamarshi or anybody else by spending your time with them. If you abandon your library work and run away from it, you will become an ungrateful wretch. For absorption in library work has secured for you in a natural way the benefits which Sanyasis have to get through arduous Sadhanas. Don't run away. Stay on with

553

willingness, in the work God has assigned to you through society. This is certain to get you ultimate peace". This was a revealing advice to me. I am glad to testify that this has been fully experienced by me ever since 1937.

7 ONE SOUL IN MANY BODIES

My prayer is that the members of the DRTC should forever work together in perfect harmony as one soul in many bodies. Whenever the snake of a sense of exclusiveness or of petty egotism, or of personal prestige, or of desire to have extra-personal credit to oneself raises its head, it should be put down. I commend the following words from Chap 3, Sec 54, of Maeterlinkck's Life of the bee (1927). "An inherent principle of the hieve [is] that the pride of toil should be distributed and every achievement be anonymous and common to all, that it might thereby become more fraternal".

8 SOME SUGGESTIONS FOR THE FUTURE OF DRTC

Here are some suggestions worthwhile being taker up by DRTC during the next decade.

81 Accommodation

The DRTC has outgrown the capacity of the present rented campus. This will introduce many undesirable elements. Therefore, the parent body of DRTC should erect the necessary buildings in the extensive site already acquired in the Mysore Road, Bangalore.

1 The main building should provide for lecture rooms, demonstration rooms, exhibition rooms, and comfortable rooms for each of the teachers to enable them to hold the tutorial classes, and small group discussions in their respective rooms;

2 Accommodation for the library, designed in the most functional manner, as part of the main building;

3 Quarters for all the members of the staff including the servants. A hostel building with all the modern amenities, providing a separate living room for the regular student and for the visiting librarians coming to DRTC for a limited period to do a specific piece of work under the guidance of the teachers;

4 A guest house with at least three rooms to accommodate visiting lecturers;

5 Provision for water-supply, electricity and other amenities drawn from the municipal supply, with certain precautionary measures, such as overhead tank for water.

82 Getting the Cooperation of the Industries and Research Institutions

At present, some effort is being made to convince the industries and the research institutions about the value of having specialist libraries of their own and manning them with documentalists, and for this purpose, deputing candidates for training in DRTC. It is slowly bearing fruit. Ways and means should be found to enlarge this effort.

83 Increasing the Admission to DRTC

As the industries realise the importance of

the training in DRTC, need will arise to increase the admission. But this should not result in large classes inevitably leading to mass teaching the place of the large amount of individual attention and instruction now so effectively and purposefully practised. The plan should be to open more units of the present size of teachers and students. Each unit will continue to work as the existing unit does. But all the units should share in common activities such as (1) Weekly colloquia; and (2) Annual Seminars.

84 Same Campus and a Single Head

It goes without saying that all the units, including the entire staff and students, should be in the same campus with intimate relation with one another under a single head.

85 Follow-up Work

Necessity will arise to take steps to place the alumni in appropriate places, and to follow their career closely with full interest. There should be intensification of the present practice of keeping in close intellectual relation with the Alumni and stimulating them to engage themselves in some piece of research or other germane to their doing work, and providing opportunity for exchange of their results through the Annual Seminars, Periodicals, and other publications.

86 Consultant Service

A small squad of Consultant-Documentalists should be maintained by DRTC and send them to particular industries and other agencies in the country to give them consultant service. This will require a very careful planning so that the cost of the consultant staff is made of entirely by the consultant fee collected.

556

32 PROJCET 2

Project 2, to be completed within eight months after the formal course in DRTC, consists of the preparation of a Trend Report on an approved specific subject based on the survey of the current documents on the subject appearing in various periodicals, reports, etc.

4 DURATION

The formal course commences on 15 April every year and continues till about 14 April the following year.

5 ADMISSION

A candidate seeking admission to the course should ordinarily possess any one of the following minimum basic academic qualifications:

1 Post-graduate Diploma or a Bachelor's Degree in Library Science or an equivalent:

Or

2 Master's degree in any subject or a degree or a post-graduate diploma in Engineering, Technology, Agriculture, Animal Husbandry, or Medicine, and at least two years' working experience in a specialist library or documentation centre.

Admission to the course is strictly based on the merit of a candidate as judged by his academic record, and if necessary, performance in a special admission test held for the purpose or a personal interview by a selection committee.

6 AWARDS FOR PROFESSIONAL ATTAINMENTS

1 Associateship in Documentation on the basis of examination and the report of professional work in DRTC; (The Associateship is declared equivalent to the M Lib Sc degree by the Government of India).

2 Associate Fellowship in Documentation on the basis of report/thesis of research work done in DRTC;

3 Fellowship in Documentation for outstanding contributions and published works in the field of documentation.

7 RESEARCH FELLOWSHIP

Some research fellowships are available to pursue advanced work in DRTC. There is also provision for research fellows to work with Dr S R Ranganathan, National Research Professor in Library Science, and Hon Professor, DRTC.

A practising documentalist will be provided facilities to reside in DRTC for a specific period to pursue a specific line of research in the field of documentation.

8 PUBLICATIONS

1 *Library science with a slant to documentation*, a quarterly, published in collaboration with the Sarada Ranganathan Endowment for Library Science;

2 Proceedings of the Annual DRTC Seminar; and

3 Proceedings of the Mid-year Seminar.

See also : Back of half-title page